3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The affected environmental conditions described in this Chapter provide the context for understanding the environmental consequences described in Chapter 4. As such, they serve as a baseline from which any environmental changes that may be brought about by implementing the Proposed Action (Preferred Alternative) and No Action Alternative can be identified and evaluated; the baseline conditions are the currently existing conditions. The affected environments at each facility are described for the following impact areas: land resources, air resources, water resources, ambient noise, geology and soils, biological resources, socioeconomics, cultural resources, and hazardous materials and waste.

For this *Final Constellation Programmatic Environmental Impact Statement*, the U.S. Government and commercial facilities that are described in detail in this Chapter include John F. Kennedy Space Center (KSC), John C. Stennis Space Center (SSC), Michoud Assembly Facility (MAF), Lyndon B. Johnson Space Center (JSC), George C. Marshall Space Flight Center (MSFC), John H. Glenn Research Center (GRC) at Lewis Field and at Plum Brook Station (PBS), Langley Research Center (LaRC), Ames Research Center (ARC), White Sands Missile Range (WSMR)/Johnson Space Center White Sands Test Facility (WSTF), and Alliant Techsystems-Launch Systems Group (ATK) facilities at Clearfield and Promontory, Utah. Other U.S. Government facilities that would be involved in the Constellation Program, but are not discussed in detail, include Dryden Flight Research Center (DFRC), Goddard Space Flight Center (GSFC), and the Jet Propulsion Laboratory (JPL). The Constellation Program also would be supported by various other commercial facilities throughout the U.S. which are not discussed in detail. Figure 3-1 provides the locations of the facilities discussed in detail, along with DFRC, GSFC, and JPL.

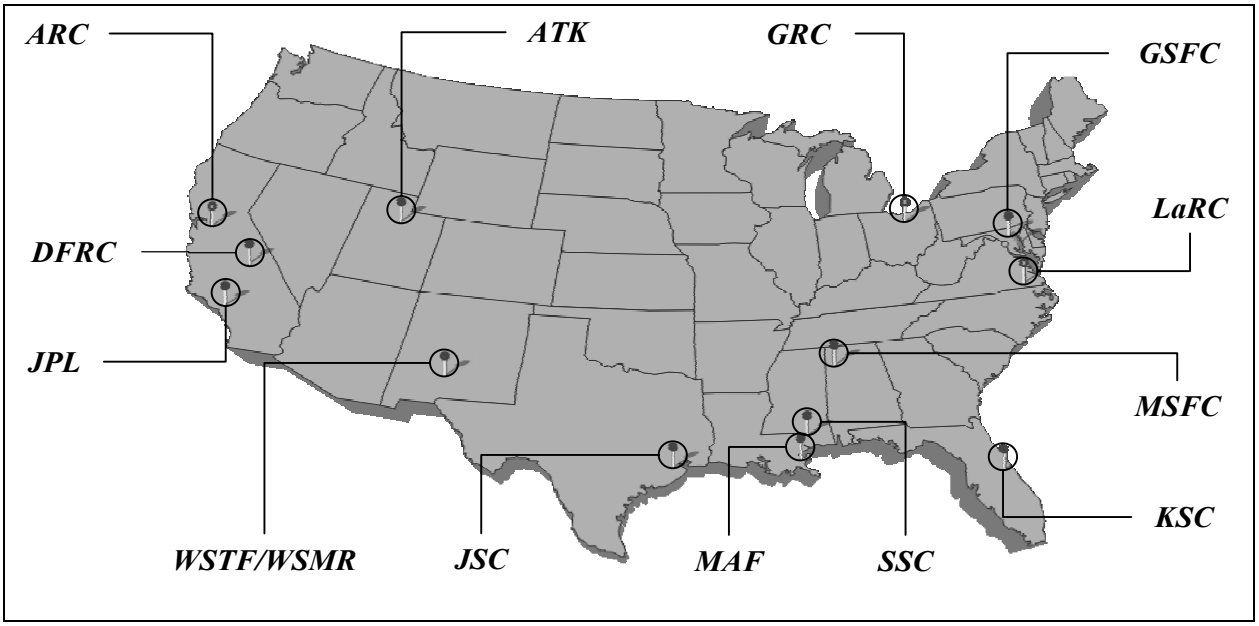


Figure 3-1. Principal U.S. Government and Commercial Facilities Contributing to the Constellation Program

A description of the proposed activities at each facility is provided in Section 2.1. These activities would be expected to be within the scope of activities normally undertaken at each facility. Any activities that are determined to be outside the scope of activities that would normally be undertaken at a facility, and are not addressed in this Final Programmatic Environmental Impact Statement (PEIS), would be subject to separate NEPA review and documentation, as appropriate.

This Chapter also describes at a high level the oceans that could be impacted as a result of jettisoned components from an Ares launch and from a returning Orion Crew Module/Service Module, and an Orion water landing. Terrestrial landing sites are currently under study and therefore are not addressed in this Chapter. Impacts associated with terrestrial landing sites would be addressed in separate NEPA documentation, as appropriate.

3.1 U.S. GOVERNMENT FACILITIES

3.1.1 John F. Kennedy Space Center

The primary mission of the National Aeronautics and Space Administration's (NASA's) KSC is to process and launch the Space Shuttle and future generations of crewed space vehicles and to process payloads for various expendable launch vehicles launched from Cape Canaveral Air Force Station (CCAFS). Launches from KSC are coordinated with Launch Range Safety at CCAFS. For the Constellation Program, KSC would manage the Ground Operations Project, including pre- and post-launch ground processing, launch support, and landing and recovery planning and execution.

3.1.1.1 Land Resources

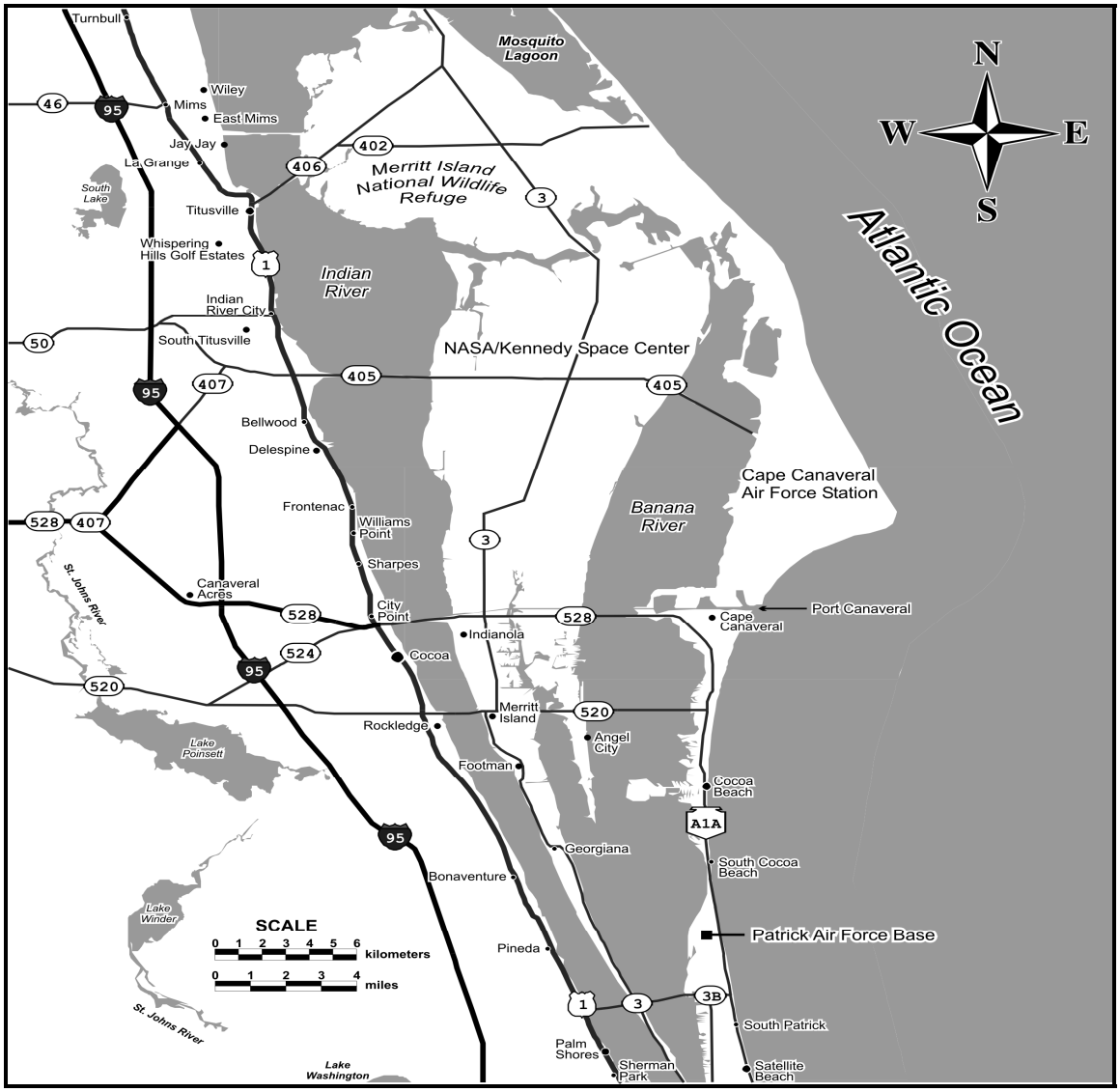
KSC is located on the east coast of Florida approximately 242 kilometers (km) (150 miles [mi]) south of Jacksonville and 64 km (40 mi) due east of Orlando on the north end of Merritt Island, which forms a barrier island complex adjacent to Cape Canaveral. KSC is composed of 56,000 hectares (ha) (139,490 acres [ac]) of land and open water resources in Brevard and Volusia Counties (KSC 2003).

KSC is bordered on the west by the Indian River and on the east by the Atlantic Ocean and CCAFS (see Figure 3-2). The southern boundary of KSC runs along the Merritt Island Barge Canal, which connects the Indian River with the Banana River and Port Canaveral at the southern tip of Cape Canaveral. The northern border lies in Volusia County near Oak Hill across Mosquito Lagoon (KSC 2003).

Undisturbed areas, including uplands, wetlands, mosquito control impoundments, and open water areas, comprise approximately 95 percent of the total KSC area. Nearly 40 percent of KSC consists of open water areas. NASA maintains operational control of approximately 1,806 ha (4,463 ac) of KSC. NASA's operational area contains developed facility sites, roads, lawns, and maintained right-of-ways (see Figure 3-3). The remaining undeveloped portions of the operational area are dedicated as safety zones around existing facilities or held in reserve for future expansion. Developed facilities within the NASA operational area are dominated by the Space Shuttle Landing Facility, the Industrial Area, and the Vehicle Assembly Building (VAB) Area. The areas outside the NASA operational control area, including the Canaveral National

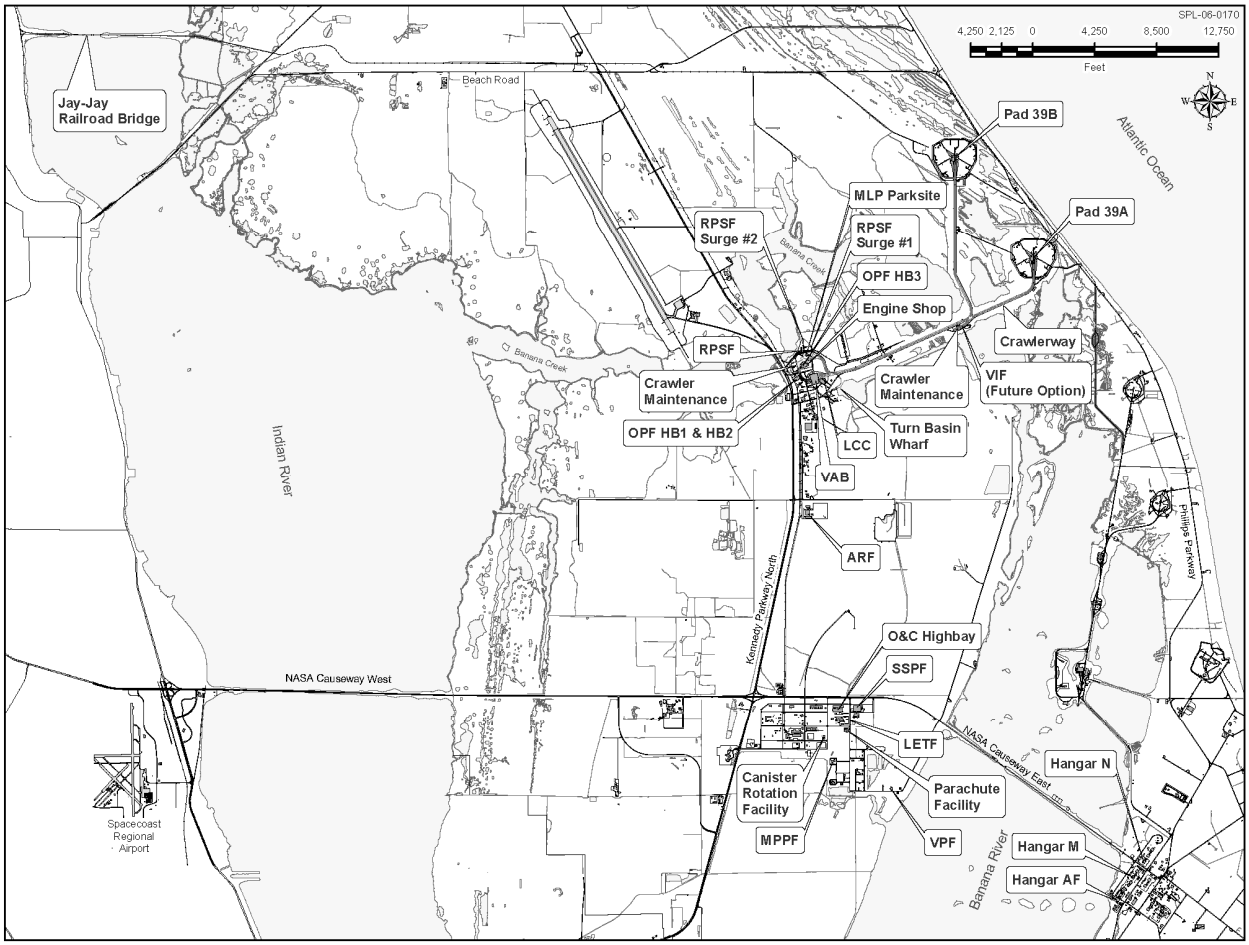
Seashore and Merritt Island National Wildlife Refuge (MINWR), are managed by the National Park Service and U.S. Fish and Wildlife Service (USFWS) (KSC 2003). In December 2006, USFWS issued the *Draft Comprehensive Conservation Plan and Environmental Assessment for Merritt Island National Wildlife Refuge* to better manage MINWR (71 *Federal Register* [*FR*] 77783).

Land use surrounding KSC includes an active seaport; recreation and wildlife management areas; and agricultural uses that include citrus and other crops and pasturage. Major municipalities outside of, but near, KSC include the city of Titusville, which is approximately 15.2 km (9.5 mi) from the KSC Industrial Area and the city of Cape Canaveral, which is approximately 13.6 km (8.5 mi) from the KSC Industrial Area.



Source: NASA 2006d

Figure 3-2. KSC and the Surrounding Area



Source: KSC 2006b

Figure 3-3. KSC Facilities Map

3.1.1.2 Air Resources

3.1.1.2.1 Climate

The climate at KSC can be classified as subtropical with hot, humid summers and short, mild, and dry winters. Average annual temperatures range from approximately 57 to 80 degrees Fahrenheit (°F) (13.9 to 26.7 degrees Celsius [°C]) and rainfall averages more than 114 centimeters (cm) (45 inches [in]) per year. Seasonal wind directions are primarily influenced by continental temperature changes. In general, fall winds are predominantly from the east to northeast. Winter winds are predominantly from the north to northwest, shifting to the southeast in the spring and then to the south in the summer (KSC 2003). KSC is vulnerable to hurricanes and tornados and associated storm tides (NOAA 2007).

3.1.1.2.2 Air Quality

The Clean Air Act (CAA), as amended (42 United States Code [U.S.C.] 7401 *et seq*.), requires the U.S. Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) (40 Code of Federal Regulations [CFR] part 50) for pollutants considered harmful to public health and the environment. The CAA established two types of national air quality standards. *Primary standards* set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. *Secondary standards* set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings (EPA 2006f).

The Clean Air Act requires EPA to designate areas as *nonattainment* for any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the primary or secondary NAAQS for the pollutant; *attainment* for any area (other than an area identified in clause [i]) that meets the primary or secondary NAAQS for the pollutant; and unclassifiable for any area that cannot be classified on the basis of available information as meeting or not meeting the primary or secondary NAAQS for the pollutant (EPA 2007c).

EPA has set NAAQS for six principal pollutants, which are called "criteria" pollutants (see Table 3-1). Units of measure for the standards are parts per million (ppm) by volume, milligrams per cubic meter (mg/m^3) of air, and micrograms per cubic meter ($\mu g/m^3$) of air (EPA 2006f). Air quality standards for the State of Florida are the same as the NAAQS except for sulfur dioxide (SO_2) and nitrogen dioxide (NO_2). The annual arithmetic mean for SO_2 is 0.02 ppm and is 0.05 ppm for NO_2 under the Florida standard (Florida Administrative Code [FAC] 62-204.240).

Brevard and Volusia Counties are considered to be in attainment or unclassifiable for all criteria pollutants regulated under the NAAQS and state standards (EPA 2007c, FDEP 2004).

Ambient air quality at KSC is influenced by NASA operations, land management practices, vehicle traffic, and emission sources outside KSC. Daily air quality conditions are influenced primarily by vehicle traffic, combustion sources (*e.g.*, boilers), and standard refurbishment and maintenance operations. Air quality at KSC also is influenced by emissions from two regional power plants, which are located within 16.1 km (10 mi) of KSC. Space launches, wildfires, and controlled burning operations influence air quality as episodic events (KSC 2003).

Title V of the CAA requires facilities that have the potential to emit more than 90.72 metric tons (mt) (100 tons) per year of criteria pollutants, more than 22.68 mt (25 tons) per year of hazardous air pollutants (HAP), or more than 9.072 mt (10 tons) per year of any one HAP to obtain a major source or synthetic minor source operating permit. Sources with the potential to exceed these thresholds are classified as major unless they accept operating permit conditions limiting their emissions below these levels (in which case they are classified as synthetic minor sources). KSC is permitted as a major source of air emissions and operates under a Title V permit (KSC 2003).

Table 3-1. National Ambient Air Quality Standards

Pollutant	Primary Standards	Averaging Times	Secondary Standards
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour[(a)]	None
	35 ppm (40 mg/m^3)	1-hour[(a)]	None
Lead	1.5 µg/m^3	Quarterly Average	Same as Primary
Nitrogen Dioxide	0.053 ppm (100 µg/m^3)	Annual (Arithmetic Mean)	Same as Primary
Particulate Matter (PM_{10})	150 µg/m^3	24-hour[(b)]	—
Particulate Matter ($PM_{2.5}$)	15.0 µg/m^3	Annual[(c)] (Arith. Mean)	Same as Primary
	35 µg/m^3	24-hour[(d)]	—
Ozone	0.08 ppm	8-hour[(e)]	Same as Primary
Sulfur Dioxide	0.03 ppm	Annual (Arith. Mean)	—
	0.14 ppm	24-hour[(a)]	—
	—	3-hour[(a)]	0.5 ppm (1,300 µg/m^3)

Source: EPA 2006f

(a) Not to be exceeded more than once per year.

(b) Not to be exceeded more than once per year on average over 3 years.

(c) To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.

(d) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3.

(e) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

3.1.1.3 Water Resources

3.1.1.3.1 Potable Water

KSC obtains its potable water under contract from the city of Cocoa, which draws its supplies from the Floridan Aquifer. KSC uses approximately 4.9 million liters (l) (1.3 million gallons [gal]) of water per day. The water distribution system at KSC is sized to accommodate the short-term, high-volume flows required for launches (KSC 2003).

3.1.1.3.2 Surface Water

Major water bodies surrounding KSC include the Atlantic Ocean and the inland estuary consisting of the Indian River, the Banana River, and the Mosquito Lagoon (see Figure 3-2). The inland estuary has been designated as an Estuary of National Significance, and contains Outstanding Florida Waters and Aquatic Preserves (KSC 2003, EPA 2007a). Freshwater inputs to the estuary include direct precipitation, stormwater runoff, discharges from impoundments, and groundwater seepage (KSC 2003).

The surface drainage pattern of Merritt Island is multibasinal and typically internal, being trapped in the ponds, lakes, sloughs, burrows, and constructed canals on the Island. External drainage is conducted primarily by constructed drainage systems (*i.e.*, Industrial Area to the

Banana River via Buck Creek) and by way of grove management pumps to the Indian River. These drainage systems are most prevalent in the developed areas and surrounding uplands adjacent to the bordering water bodies previously mentioned (KSC 2003).

KSC transports its raw domestic wastewater to the CCAFS Regional Treatment Plant located on CCAFS. KSC maintains operating permits for two industrial wastewater treatment facilities. Launch Complex (LC)-39 Pads A and B utilize holding tanks to treat industrial wastewater streams generated by fire and sound suppression water, Solid Rocket Booster (SRB) exhaust, and post-launch wash down. Stormwater runoff is controlled by more than 100 onsite surface water management systems and a National Pollutant Discharge Elimination System (NPDES) storm water permit for industrial activities.

The majority of KSC lies within the 100-year floodplain and the areas adjacent to LC-39 Pads A and B and the Industrial Area are within the 500-year floodplain. LC-39 Pads A and B are excluded from both floodplains (KSC 2003). There are no national or state-designated wild or scenic rivers on or near KSC or CCAFS; however, the Banana and Indian Rivers and the Mosquito Lagoon makeup the Indian River Lagoon which has been designated an Estuary of National Significance (DOI 2006).

Surface water quality at KSC and CCAFS has been characterized as generally good. The waters tend to be alkaline and have good buffering capacity. Water samples from inland bodies of water near KSC and CCAFS have indicated that some polyaromatic hydrocarbons, one pesticide (dieldrin), and some metals were measured above detection limits (KSC 2003).

3.1.1.3.3 Groundwater

KSC is underlain by three aquifers, including the surficial aquifer, the secondary semi-confined aquifer, and the Floridan Aquifer. The surficial aquifer is largely recharged by rainfall percolation and surface runoff and is used by the areas near KSC for nonpotable uses; however, Mims and Titusville, located approximately 16 km (10 mi) northwest of KSC, and Palm Bay, located approximately 64 km (40 mi) south of KSC, use this aquifer for public water supply. Surface recharge of the secondary, semi-confined aquifer is minor and depends on leakage through surrounding lower-permeability soils. The Floridan Aquifer is the primary source of potable water in central Florida (KSC 2003, USAF 1998).

In the immediate vicinity of KSC, groundwater from the Floridan Aquifer is highly mineralized. Water quality in the secondary semi-confined aquifer varies from moderately brackish to brackish. Groundwater quality in the surficial aquifer system at KSC is generally good due to immediate recharge, active flushing, and a lack of development. Groundwater from the surficial aquifer meets Florida's criteria for potable water and national drinking water criteria for all parameters other than iron and total dissolved solids (USAF 1998).

3.1.1.3.4 Offshore Environment

From the coastline, sandy shoals lead to a deepening sea floor. Offshore currents usually reflect the general northern flow of the Gulf Stream (NOAA 1980). Studies of water movements in the

area indicate surface to bottom shoreward currents, although wind generally determines current flow at the surface.

3.1.1.4 Ambient Noise

The 24-hour average ambient noise level on KSC is appreciably lower than the EPA recommended upper level of 65 decibels (dBA). Noise generated at KSC can be attributed to six general sources, including Space Shuttle atmospheric entry sonic booms, launches, aircraft movement, industrial operations, construction, and traffic noise (KSC 2003). Sonic booms associated with Space Shuttle entry at KSC are not expected to occur after 2010. The areas of KSC/MINWR that are away from operational areas are exposed to relatively low ambient noise levels in the range of 35 to 40 dBA (KSC 2003).

3.1.1.5 Geology and Soils

3.1.1.5.1 Geology

Merritt Island and the adjacent Cape Canaveral form a barrier island complex of Pleistocene and Recent Age. Surface deposits consist primarily of sand and sandy coquina (a coarse grained, porous limestone composed principally of mollusk shell and coral fragments). The topography is marked by a series of ridges and swales derived from relict dunes deposited as the barrier islands were formed. Erosion has reduced the western side of Merritt Island to a nearly level plain. Elevation ranges from sea level to approximately 3 meters (m) (10 feet [ft]) in the inland areas and to 6 m (20 ft) on the recent dunes. KSC is in an area that exhibits high seismologic stability with very few confirmed earthquakes (KSC 2003).

3.1.1.5.2 Soils

Soils of the area have been derived primarily from deposits of sand and sandy coquina, but vary greatly with landscape position, drainage, and age of parent material (KSC 2003). In general, soils around KSC are highly permeable, allowing water to quickly percolate into the ground and have a high buffering capacity (CCAFS 1998).

3.1.1.6 Biological Resources

The KSC region has several terrestrial and aquatic conservation and special designation areas (*e.g.*, wildlife management areas and aquatic preserves). These areas serve as wildlife habitat and occupy approximately 405,000 ha (1 million ac) of the total land and water area in the surrounding region (KSC 2003).

The majority of the land at and near KSC, including CCAFS, MINWR, Mosquito Lagoon, and the Cape Canaveral National Seashore, is undeveloped and in a near-natural state. More than 50 percent of KSC is classified as wetlands. These areas host a variety of plant communities that support many resident and transient animal species. The aquatic environment surrounding KSC provides diverse fish habitat, which supports many shore bird species, and sport, commercial, and recreational fishing. The Atlantic beaches at KSC, CCAFS, and the Canaveral National

Seashore are important to nesting sea turtles. In addition, the Mosquito Lagoon is considered among the best oyster and clam harvesting areas on the east coast (KSC 2003).

The Magnuson Fishery Conservation and Management Act of 1976, as amended (16 U.S.C. 1801 *et seq*.), mandates the conservation of essential fish habitat.

USFWS currently recognizes 113 endangered or threatened and 27 candidate animal and plant species in the State of Florida (FWS 2007). The State of Florida considers 118 animal species as threatened, endangered, or of special concern (FFWCC 2007) and 55 plant species as threatened or endangered (FDACS 2007). Brevard County has listed 53 plant species as threatened, endangered, or commercially exploited (BCBCC 2003).

Many of these threatened, endangered, or species with special designations are known to occur at KSC, including four amphibian and reptile state species of special concern (Florida gopher frog [*Rana capito aesopus*], American alligator [*Alligator mississippiensis*], gopher tortoise [*Gopherus polyphemus*], and Florida pine snake [*Pituophis melanoleucus mugitus*]), four state and/or federally threatened species (Atlantic salt marsh snake [*Nerodia clarkii taeniata*], loggerhead turtle [*Caretta caretta*], American alligator, and eastern indigo snake [*Drymarchon couperi*]) and two state and federally endangered species (Atlantic green sea turtle [*Chelonia mydas*] and leatherback sea turtle [*Dermochelys coriacea*]). Protected birds include eight state species of concern (black skimmer [*Rynchops niger*], Eastern brown pelican [*Pelecanus occidentalis carolinensis*], little blue heron [*Egretta caerulea*], reddish egret [*Egretta rufescens*], roseate spoonbill [*Ajaia ajaja*], snowy egret [*Egretta thula*], tricolored heron [*Egretta tricolor*], and white ibis [*Eudocimus albus*]), three state and federally threatened species (Florida scrub-jay [*Aphelocoma coerulescens*], least tern [*Sterna antillarum*] and Southeastern American kestrel [*Falco sparverius paulus*]), and two state and federally endangered species (wood stork [*Mycteria Americana*] and Arctic peregrine falcon [*Falco peregrinus tundrius*]). Protected mammals at KSC include one state species of special concern (Florida mouse [*Podomys floridanus*]), one state and federally threatened species (Southeastern beach mouse [*Peromyscus polionotus niveiventris*]), and one state and federally endangered species (West Indian manatee [*Trichechus manatus*]). The federally protected bald eagle (*Haliaeetus leucocephalus*) is also known to occur at KSC (KSC 2003).

3.1.1.7 Socioeconomics

This section addresses the existing socioeconomic conditions and characteristics in the KSC regional area. The KSC regional area is defined here as the land area within an 80.5 km (50 mi) radius of KSC, which consists of Seminole, Brevard, Orange, and portions of Osceola, and Volusia Counties (USBC 2006a).

3.1.1.7.1 Population

The total population within the KSC regional area was approximately 1,983,260 persons in 2000 (see Table 3-2) (USBC 2006a). The total population is expected to increase to approximately 2,324,050 by 2010 and to approximately 2,691,970 by 2020. Similar increases are anticipated in Brevard County, where the total population was approximately 476,230 persons in 2000 and is

expected to increase to approximately 558,060 by 2010 and to approximately 646,410 by 2020 (USBC 2000).

Table 3-2. Population of the KSC Regional Area and Brevard County for 2000, 2010, and 2020

Population	KSC Regional Area			Brevard County		
	2000	2010*	2020*	2000	2010*	2020*
White	1,548,175	1,735,630	1,933,261	413,411	463,467	516,241
Black or African American	254,244	307,256	361,212	40,000	48,340	56,829
American Indian and Alaska Native	6,773	8,462	10,184	1,765	2,205	2,654
Asian	44,636	60,686	78,295	7,152	9,724	12,545
Native Hawaiian and Other Pacific Islander	1,328	1,806	2,329	305	415	535
Some other race	77,616	100,802	126,430	5,168	6,712	8,418
Two or more races	50,492	—	—	8,429	—	—
Hispanic or Latino (of any race)	258,769	357,307	471,020	21,970	30,336	39,991
Total Population	**1,983,264**	**2,324,048**	**2,691,967**	**476,230**	**558,061**	**646,407**
Percent Minority	**21.94**	**25.32**	**28.18**	**13.19**	**16.95**	**20.14**

Sources: USBC 2000, USBC 2006a

* Projected population values for 2010 and 2020 do not represent absolute limits to growth; for any group, the future population may be above or below the projected value.

Note: Because an individual may report more than one race, the aggregate of the population groups may not match the total population.

In 2000, minority race populations represented approximately 22 percent of the total population within the KSC regional area and approximately 13 percent of the total population within Brevard County. Hispanic or Latino (of any race) and Black or African American populations were the largest minority groups living within the KSC regional area and Brevard County in the year 2000. Between 2000 and 2020, minority race populations are expected to increase to 28 percent of the total population within the KSC regional area and approximately 20 percent of the total population within Brevard County. The Hispanic or Latino (of any race) population is expected to be the largest resident minority group within the KSC regional area, while the Black or African American population is expected to be the largest minority group within Brevard County in 2020 (USBC 2006a, USBC 2000).

3.1.1.7.2 Economy

Industrial sectors in the KSC regional area that provide significant employment include education, health and social services; arts, entertainment, recreation, accommodation and food services; retail trade; and professional, scientific, management, administrative, and waste management services. An estimated 1,567,361 people were employed in the KSC regional area in 2000 with an estimated unemployment rate of 5.1 percent. The national and Florida

unemployment rates during the same period were estimated at 5.8 and 5.6 percent, respectively. The estimated percent of persons living below the poverty level (low-income persons) in 2000 was as follows: U.S. – 12.4 percent, Florida – 12.5 percent, KSC regional area – 10.6 percent, and Brevard County – 9.3 percent (USBC 2006a). KSC's regional area economic base is tourism and manufacturing, with tourism attracting more than 20 million visitors annually. Multiple theme parks, along with KSC, are among the most popular tourist attractions in the State. In addition, the cruise and cargo industries at Port Canaveral contribute to the Central Florida economy (Central Florida includes Brevard, Flagler, Lake, Orange, Osceola, Seminole, and Volusia Counties).

The space industry also contributes significantly to the local, state, and national economies. In fiscal year 2005, KSC and other NASA space operations created a total economic impact in Florida of $3.7 billion in output, $1.8 billion in income, and 35,000 jobs. The total economic impact was highly concentrated in Central Florida with an output impact of $3.2 billion, an income impact of $1.6 billion, and an employment impact of 32,000 workers. These activities generated $197 million of Federal taxes and $85 million of state and local taxes (KSC 2005). In 2006, KSC was Brevard County's largest single employer with more than 15,640 employees. The vast majority of KSC's workforce lives in Brevard County (KSC 2006c).

3.1.1.7.3 Transportation

KSC has fully developed infrastructure, including road access and all utilities to support its occupational needs. The region is supported by a network of Federal, state, and county roads, rail service, three major airports, and a seaport with cargo and cruise terminals (KSC 2003). Both KSC and CCAFS have runways to support government aircraft, delivery of launch vehicle components, and air freight associated with the operation of launch complexes (USAF 2002).

3.1.1.7.4 Public and Emergency Services

Emergency medical services for KSC and CCAFS personnel are provided by the Occupational Health Facility at KSC. Additional health care services are provided by nearby public hospitals located outside KSC. Fire protection is provided by three onsite fire stations. Police protection is provided by the joint base operations support contractor at KSC and CCAFS (KSC 2003). In addition, a mutual-aid agreement exists between KSC, the city of Cape Canaveral, Brevard County, and the range contractor at CCAFS for reciprocal support in the event of an emergency or disaster (USAF 1998). Further, CCAFS and the Brevard County Office of Emergency Management have agreements for communications and early warning in the event of a launch accident.

During launch periods, Launch Range Safety at CCAFS monitors launch surveillance areas to ensure that risks to people, aircraft, and surface vessels are within acceptable limits. Control areas and airspace are closed to the public as required and Notice to Airmen (NOTAM) and Notice to Mariners are disseminated prior to launch. In addition, warning signs are posted in various Port Canaveral areas for vessels leaving port. Patrick Air Force Base (AFB) also maintains an Internet website and toll-free telephone number with launch hazard area information for mariners and restricted airspace information for pilots.

3.1.1.8 Cultural Resources

The following sites at KSC would be associated with the Constellation Program and are listed in the National Register of Historic Places (NRHP): Crawlerway, LC-39 Pad A (Building J8-1708) and Pad B (Building J7-0037), Launch Control Center (Building K6-099), Operations and Checkout Building (Building M7-0335), Vehicle Assemble Building (VAB) (Building K6-0848), and the Missile Crawler Transporter Facilities. In addition, Pad A and Pad B at LC-39 are each designated Historic Districts.

Facilities at KSC that would be associated with the Constellation Program and are eligible for individual listing in the NRHP include the Hangar AF (Building 66250), Manufacturing Building (Building L6-247), Rotation Processing and Surge Facility (Building K6-494), Parachute Refurbishment Facility (Building M7-657), and the Orbiter Processing Facility (Building K6-894) and the Orbiter Processing Facility High Bay 3 (Building K6-696).

There are no known archeological resources associated with Constellation Program activities.

3.1.1.9 Hazardous Materials and Waste

KSC uses hazardous materials for various institutional activities, which in turn generate hazardous wastes. Such waste is managed in accordance with applicable Federal, state, and local rules and regulations and the KSC plan for managing hazardous materials and waste. KSC is classified as a large-quantity generator of hazardous wastes and is regulated by a Resource Conservation and Recovery Act (RCRA) permit (number FL68000014585) for the storage, treatment, and disposal of such hazardous waste (NASA 2007a). Facilities that generate 1,000 kilograms (kg) (2,200 pounds [lb]) or more of hazardous waste per calendar month, or more than 1 kg (2.2 lb) of acutely hazardous waste per calendar month are classified as large-quantity generators (40 CFR 262). In 2006, KSC generated 119,422 kg (263,278 lb) of hazardous wastes (KSC 2006d).

NASA submits annual reports under the Emergency Planning and Community Right-to-Know Act (EPCRA) Toxic Release Inventory Program for the release of pollutants at KSC. In 2001, reports were submitted for epichlorohydrin, methyl hydrazine, Freon® 113, tetrachloroethylene, and lead (NASA 2007a).

KSC operates a permitted Class III landfill that is expected to handle the solid waste (construction and demolition debris only) disposal needs of KSC for an estimated 13 to 49 years, based on assumed disposal rate scenarios of 82 mt (90 tons) to 318 mt (350 tons) per week. The landfill is unlined and does not accept putrescible household waste (KSC 2003). All other nonhazardous solid wastes are shipped to the Brevard County Landfill.

3.1.2 John C. Stennis Space Center

NASA's SSC is responsible for testing and flight-certifying large rocket propulsion systems for the Space Shuttle and future generations of space vehicles. For the Constellation Program, SSC would be responsible for liquid hydrogen/liquid oxygen propulsion engine testing and verification for the Ares Upper Stage and Ares V Core Stage.

3.1.2.1 Land Resources

SSC is located along the northern edge of the Gulf of Mexico in western Hancock County, Mississippi, approximately 89 km (55 mi) northeast of New Orleans and approximately 48 km (30 mi) west of Biloxi/Gulfport, Mississippi. SSC encompasses approximately 5,585 ha (13,800 ac) of land that constitute the "Fee Area" or the confines within the gates of SSC (see Figure 3-4). Land use within the Fee Area consists primarily of general institutional facilities, industrial and test areas, laboratories, recreational and open areas, and roadway and parking areas (see Figure 3-5) (SSC 2005).

A restrictive easement extends 9.7 km (6 mi) in all directions from the Fee Area, which acts as a "Buffer Zone" (see Figure 3-4). Provisions of the restrictive easement prohibit maintenance or construction of dwellings and other buildings suitable for human habitation. The purpose of the 50,588 ha (125,001 ac) Buffer Zone is to provide an acoustical and safety protection zone for NASA testing operations. Predominant land use in the Buffer Zone includes sand and gravel mining, timber production, and recreational activities. Urban areas interspersed with open space, such as coastal wetlands, adjoin the perimeter of the Buffer Zone (SSC 2005).

Test Complex "A" includes two single position test stands (A-1 and A-2); a test control center; observation bunkers; and support systems for high pressure gas (air, helium, and nitrogen), water, electrical, and propellants (liquid oxygen and liquid hydrogen). Test Complex "B" includes one dual position test stand, a test control center, a machine shop, similar support systems as Complex "A", and docking and transfer for liquid propellant barges (SSC 2005).

3.1.2.2 Air Resources

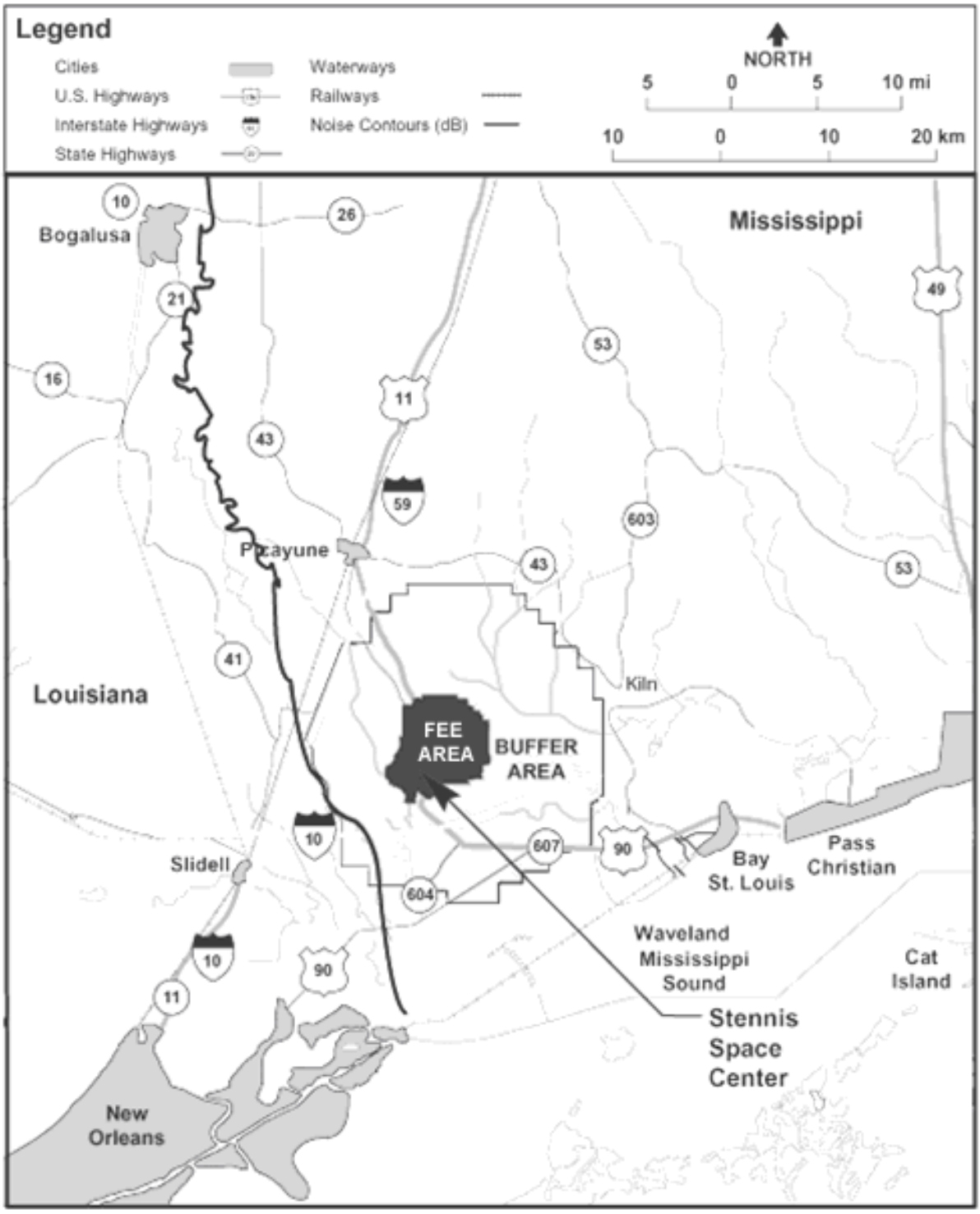
3.1.2.2.1 Climate

The climate at SSC can be classified as temperate and rainy with hot summers. Average annual temperatures range from approximately 53 to 79°F (12 to 26°C). Rainfall averages approximately 1.5 m (60 in) per year. Prevailing surface winds are from the south and southwest through two-thirds of the year and from the north for the rest of the year. Upper level winds generally prevail from the west and southwest. The Gulf Coast averages one tropical cyclone per year; approximately two thirds of these are of hurricane force with winds greater than 119 km (74 mi) per hour (SSC 2005).

3.1.2.2.2 Air Quality

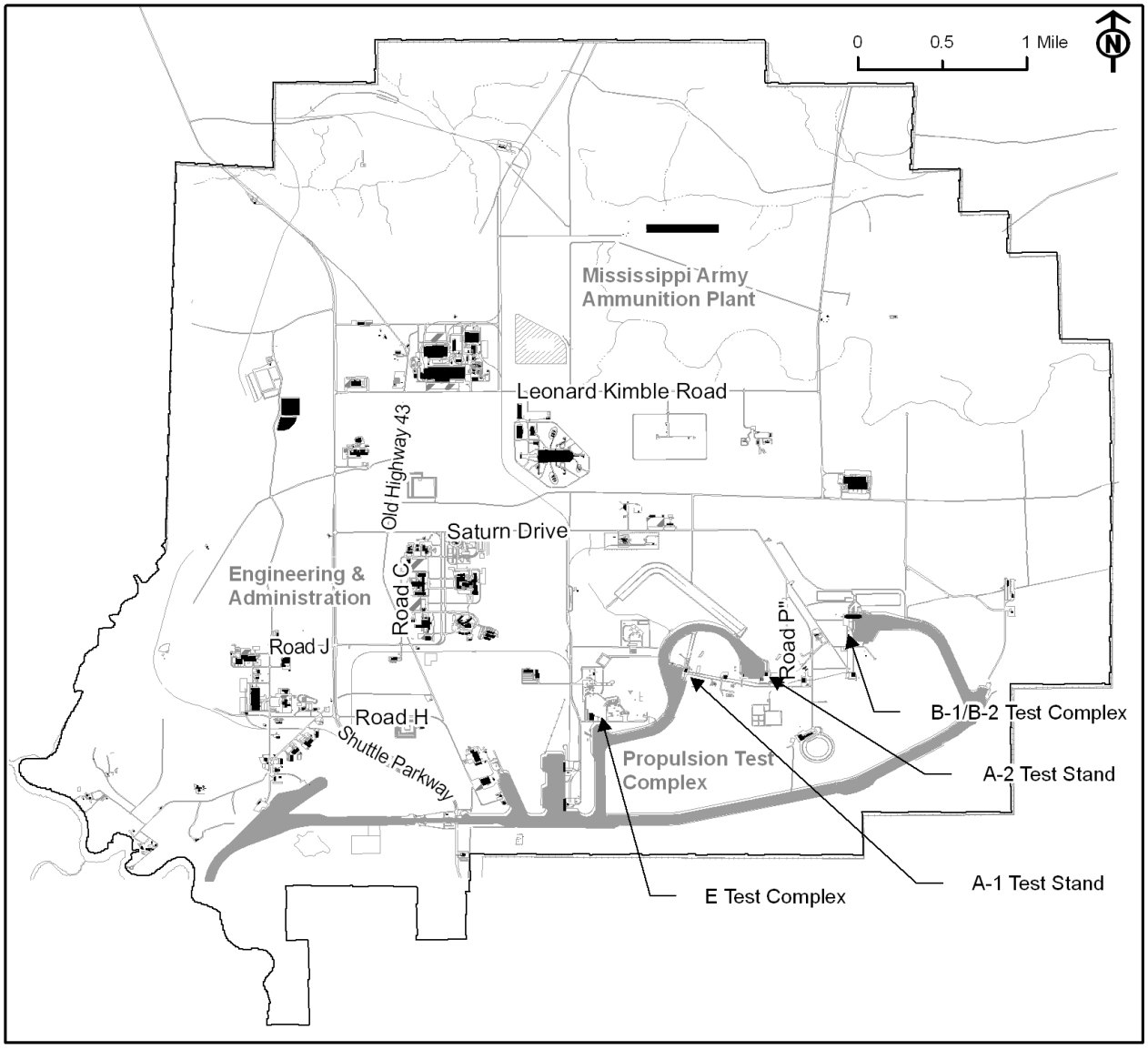
Air quality at SSC is regulated through the NAAQS promulgated under the CAA. See Section 3.1.1.2 for a discussion of primary and secondary air quality standards and criteria pollutants. Mississippi Ambient Air Quality Standards (MAAQS) are the same as the NAAQS (SSC 2005).

SSC is classified as a major source of air emissions and operates under a CAA Title V permit. Air emission sources, other than mobile sources such as automobiles and construction equipment, include combustion sources (*e.g.*, boilers), surface coating activities, fuel dispensing, abrasive (grit) blasting, rocket testing, flare stacks, metal parts cleaning, and other fugitive emissions due to chemical product usage at various locations (SSC 2005).



Source: MSFC 1997a

Figure 3-4. SSC Fee and Buffer Areas



Source: SSC 2007c

Figure 3-5. SSC Facilities Map

The State of Mississippi is classified as an attainment area for all criteria pollutants regulated under the NAAQS (EPA 2007c). Visibility in federally designated Class I areas is protected under the EPA's Regional Haze Rule. The CAA defines a Class I air quality area to include the following types of areas that were in existence as of August 7, 1977: national parks more than 2,428 ha (6,000 ac), national wilderness areas and national memorial parks more than 2,024 ha (5,000 ac), and international parks. There is one Class I air quality area within 62 mi (100 km) of SSC, the Breton National Wildlife Refuge in Louisiana. The refuge is approximately 50 mi (80 km) from the SSC test areas (MSFC 1997a).

3.1.2.3 Water Resources

3.1.2.3.1 Potable Water

Potable water for use at SSC is supplied through two large capacity wells onsite. A third well is currently not used and held in standby condition. All wells are permitted for withdraw of water by the Mississippi Department of Environmental Quality, Office of Land and Water Resources. In 2005, SSC used approximately 448 million l (118 million gal) of potable water (SSC 2007b).

3.1.2.3.2 Surface Water

SSC is located in an area with many surface water bodies. The East Pearl River flows along the southwest boundary of the Fee Area and the Jourdan River flows in a southeasterly direction through the eastern portion of the Buffer Zone. Tributaries that drain the Fee Area and are hydraulically conducted to these two rivers are Mike's River and Turtleskin Creek in the East Pearl River Basin, and the Lion and Wolf Branches of Catahoula Creek in the Jourdan River Basin. Approximately 12.1 km (7.5 mi) of constructed canals in the Fee Area also are connected through locks to the East Pearl River. The canal system provides a means of transporting large rocket engines, propellants, and other heavy equipment and materials to the facility.

Portions of the Pearl River that extend through the Buffer Zone and the Jourdan River from the confluence of Catahoula Creek to the Bay of St. Louis are listed on the Nationwide Rivers Inventory under the Wild and Scenic Rivers Act. The Nationwide Rivers Inventory is a listing of more than 3,400 free-flowing river segments in the U.S. that are believed to possess one or more "outstandingly remarkable" natural or cultural values judged to be of more than local or regional significance (DOI 2006). The Jourdan River has been identified as having significant recreational and archaeological resources and the Pearl River, used for SSC barge traffic, has been identified as having numerous endangered, threatened, and rare species, and as being an excellent example of a large Gulf Coastal Plain river with extensive swamplands (SSC 2005).

Water quality in the Fee Area is similar to the regional surface water quality with the exception of slightly higher concentrations of dissolved solids, with slight alkalinity in the canal. The surface waters in area streams are generally suitable for most uses (SSC 2005).

SSC operates under a Mississippi Land Disposal Stormwater General NPDES permit (number MSR500069). The land disposal stormwater permit is applicable to the operation of the SSC nonhazardous waste landfill, which allows stormwater associated with the industrial activity to be discharged into state waters. A stormwater pollution prevention plan is also in place to identify potential sources of pollution that may be expected to affect water quality from stormwater discharges associated with SSC industrial activities (NASA 2007a).

In May 2004, SSC was reissued a surface water discharge permit (number MS0021610) by the State of Mississippi under the NPDES program. SSC also maintains a surface water quality monitoring program in the Fee Area. The primary surface water discharges include domestic wastewater and rocket testing deluge water. A wastewater pre-treatment facility and four permitted sewage treatment facilities are located at SSC (NASA 2007a).

NASA also holds a permit (number MS-SW-02432) at SSC to divert or withdraw from the public waters of the State of Mississippi for beneficial use. This permit covers an inlet and pumps that withdraw water from the East Pearl River into an elevated portion of the facility's Access Canal. The Access Canal is the primary source of industrial water at the facility. Industrial water is used for deluge water for the test stands, cooling water, and fire control. Three industrial wells are also maintained as a back-up system for the surface water withdrawal system (NASA 2007a).

A detention pond exists at Test Complex "B" to receive runoff of cooling water from engine testing. Runoff cooling water at Test Complex "A" drains directly to the Access Canal (MSFC 1997a).

The documented floodplains at SSC include a 100-year floodplain along the East Pearl River at the western edge of the Fee Area and 100-year floodplains along the Wolf Branch and along the Lion Branch at Catahoula Creek in the northeast portion of the Fee Area. The majority of SSC is in an area of minimal flooding and there is little development in the documented floodplains at SSC. The U.S. Army Corps of Engineers has delineated a large percentage of both the Fee Area and Buffer Zone as jurisdictional wetlands. SSC is undergoing wetland mitigation in several areas to compensate for the filling of wetlands during construction activities in the Fee Area (SSC 2005).

3.1.2.3.3 Groundwater

SSC is located in an area of Hancock County that is underlain by fresh water-bearing sands. Within these fresh water-bearing sands, one unconfined aquifer is found near the surface with 10 or more confined aquifers at varying depths. Individual aquifers range 30 to 140 m (100 to 450 ft) in thickness. The aquifers have plentiful, almost untapped supplies of fresh water (SSC 2005).

Active groundwater remediation is being conducted at seven localized sites at SSC where historical spills, releases, and disposal incidents have occurred. The groundwater at six of the sites is contaminated with volatile organic compounds (VOCs), including trichloroethene (TCE) and vinyl chloride. The groundwater at the seventh site is contaminated with low levels of dioxin and TCE. The treated water is released to SSC's sanitary sewer system (SSC 2005).

3.1.2.4 Ambient Noise

Ambient noise levels at SSC are generally low with primarily continuous sources of noise, including diesel generators, pumps, boilers, and automotive traffic. However, due to the nature of rocket engine ground testing, noise, and to a small extent, vibrations, have always been an issue at SSC. Although the Buffer Zone is intended to provide enough distance for noise to dissipate to 125 dB or less at the boundary, there have been noise complaints by citizens in the communities surrounding the facility during periods of rocket engine testing. During the Saturn V rocket testing program, NASA logged 160 complaints, of which 57 resulted in formal administrative claims to NASA. Eighteen of the complaints resulted in financial settlements. While seismic effects have been minimal at SSC, years of testing the Saturn V rocket motor in

the 1960s and 1970s showed that rocket engine testing can result in swaying and falling objects at SSC and in the surrounding areas (SSC 2005).

The nearest permanent public dwellings to the test sites are on the boundary of the Buffer Area, approximately 6 mi (10 km) from the test areas. A child day care center is located on the SSC property approximately 1 mi (1.6 km) east of the test areas (MSFC 1997a).

3.1.2.5 Geology and Soils

3.1.2.5.1 Geology

SSC is located on flat low-lying terrain, with elevations in the Fee Area ranging from 1.5 to 9.1 m (5 to 30 ft) above mean sea level and approximately 1.5 to 21 m (5 to 70 ft) above mean sea level in the Buffer Area. SSC is underlain by a thick sequence of sedimentary deposits with bedrock thought to be as much as 3,000 to 3,700 m (10,000 to 12,000 ft) below the surface. SSC is considered to be under low to moderate danger from earthquakes. The facility is listed in seismic zone 0 by the Uniform Building Code, which indicates no specific design considerations (SSC 2005).

3.1.2.5.2 Soils

Soils in the Fee Area are generally composed of poorly to somewhat poorly drained silty and loamy soils. They are generally acidic with other significant characteristics of wetness, high organic matter, and weathered clay mineralogy. Some of the soils around building complexes have been modified through fill and constructed drainage (SSC 2005).

Active soil remediation is being conducted at various localized sites at SSC where past spills, releases, and disposal incidents have occurred (SSC 2005).

3.1.2.6 Biological Resources

SSC is located in an area that supports a wide array of undisturbed aquatic and biotic resources. These resources provide a broad range of natural habitat for hundreds of species of flora and fauna. The predominant types of plant communities within the SSC area include pine flatwoods, bottomland hardwood, pitcher plant bogs and swamps, and grasslands and marshes. Aquatic fauna include fish, as well as some amphibians and reptiles. Terrestrial fauna include a large variety of mammals and birds, and several species of amphibians and reptiles (SSC 2005).

The test stands that would be used to support the Constellation Program are located within an area of developed land covered by pavement or lawns and surrounded by canals and wetlands. Wildlife habitat in the immediate area of the test stands is considered marginal because of the ongoing use of the facility. This area may be a suitable foraging area for various species (*e.g.*, deer, mice, song birds, and raptors). However, activity associated with current engine tests and operations limits its suitability as a nesting or roosting habitat (MSFC 1997a).

Currently, 142 plant species that occur in the site area (Hancock County and/or St. Tammany Parish) receive special protection by the Mississippi Department of Wildlife, Fisheries and Parks and the Louisiana Department of Wildlife and Fisheries. The majority of these species are listed as "special concern" because they are known or suspected to occur in low numbers. Fifty-two of these plant species are listed as critically imperiled because of extreme rarity (five or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making them vulnerable to extinction. The Louisiana quillwort (*Isoetes louisianensis*) is the only plant species in the site area that is listed as endangered by the USFWS (SSC 2005).

Seventy-two animal species are listed as "special concern" by either the Mississippi Department of Wildlife, Fisheries and Parks and/or the Louisiana Department of Wildlife and Fisheries and have ranges that include Hancock County and/or St. Tammany Parish. Twenty of these animal species are listed as critically imperiled. Six animal species that have ranges specifically within SSC are listed as either endangered or threatened by the Mississippi Department of Wildlife, Fisheries and Parks and/or the Louisiana Department of Wildlife and Fisheries, including the Gulf sturgeon (*Acipenser oxyrhynchus desotoi*), eastern indigo snake (*Drymarchon corais couperi*), Florida panther (*Felis concolor coryi*), gopher tortoise (*Gopherus polyphemus*), bald eagle (*Haliaeetus leucocephalus*), red-cockaded woodpecker (*Picoides borealis*), and American peregrine falcon (*Falco peregrinus*). The Gulf sturgeon, eastern indigo snake, and gopher tortoise are listed as threatened by the USFWS and the red-cockaded woodpecker and the Florida panther are listed as endangered by the USFWS. The bald eagle also is a federally protected species (SSC 2005).

3.1.2.7 Socioeconomics

This section addresses the existing socioeconomic conditions and characteristics in the SSC regional area. The SSC regional area is composed of Hancock, Harrison, and Pearl River Counties in Mississippi and St. Tammany and Washington Parishes in Louisiana (SSC 2005).

3.1.2.7.1 Population

The total population within the SSC regional area was approximately 510,840 persons in 2006 (see Table 3-3) (USBC 2006a). The total population is expected to increase to approximately 519,970 by 2010 and to approximately 541,670 by 2020. Similar increases are anticipated in Hancock County where the total population was approximately 35,130 persons in 2006 and is expected to increase to approximately 35,760 by 2010 and to approximately 37,250 by 2020 (USBC 2000, USBC 2006a, USBC 2006b).

In 2006, minority race populations represented approximately 19 percent of the total population within the SSC regional area and approximately 10 percent of the total population within Hancock County. The Black or African American population was the largest minority group living within the regional area and Hancock County in the year 2006. By 2020, minority race populations are expected to increase to 20 percent of the total population within the SSC regional area and approximately 11 percent of the total population within Hancock County. The Black or African American population is estimated to remain the largest resident minority group within the SSC regional area and Hancock County in 2020 (USBC 2000, USBC 2006a).

Table 3-3. Population of the SSC Regional Area and Hancock County for 2006, 2010, and 2020

Population	SSC Regional Area			Hancock County		
	2006	2010*	2020*	2006	2010*	2020*
White	414,585	420,426	433,240	31,686	32,133	33,112
Black or African American	77,618	79,307	83,469	2,389	2,441	2,569
American Indian and Alaska Native	2,238	2,238	2,238	211	211	211
Asian	6,166	6,575	7,755	316	337	398
Native Hawaiian and Other Pacific Islander	2	2	3	0	0	0
Some other race	2,999	3,071	3,256	105	108	114
Two or more races	6,734	—	—	386	—	—
Hispanic or Latino (of any race)	11,328	12,386	15,789	632	691	881
Total Population	**510,839**	**519,970**	**541,674**	**35,129**	**35,757**	**37,249**
Percent Minority	**18.84**	**19.14**	**20.02**	**9.80**	**10.14**	**11.11**

Sources: USBC 2000, USBC 2006a, USBC 2006b

* Projected population values for 2010 and 2020 do not represent absolute limits to growth; for any group, the future population may be above or below the projected value.

Note: Because an individual may report more than one race, the aggregate of the population groups may not match the total population.

3.1.2.7.2 Economy

Industrial sectors in the SSC regional area that provided significant employment include education, health and social services; retail trade; arts, entertainment, recreation, accommodation and food services; and manufacturing (USBC 2006a). An estimated 195,150 people were employed in the SSC regional area in 2006 with an estimated unemployment rate of 7.9 percent (MDES 2006, LDOL 2007). The national and Mississippi unemployment rates during the same period were estimated at 4.6 and 7.6 percent, respectively (BLS 2007). The estimated percent of persons living below the poverty level (low-income persons) in 2000 was as follows: U.S. – 12.4 percent, Mississippi – 19.9 percent, SSC regional area – 13.6 percent, and Hancock County – 14.4 percent (USBC 2006a).

SSC contributes significantly to the local, state, and national economies. In 2006, SSC had a direct economic impact of $488 million on the SSC regional area, approximately $209 million (43 percent) of which was associated with NASA-related activities. It is estimated that SSC's activities generated $87.6 million of local taxes and $811.4 million in personal income, and supported approximately 19,500 direct and indirect jobs. NASA's onsite workforce consisted of 1,973 civil servants and support contractors in 2006 (SSC 2007a). The vast majority of SSC's workforce lives in Pearl River County, followed by Hancock and Harrison Counties and St. Tammany Parish (SSC 2007a).

3.1.2.7.3 Transportation

SSC has fully developed infrastructure, including road access and all utilities to support its occupational needs. The SSC area is served by Interstate 10 and 59, U.S. Highway 90, and Mississippi Highway 607. Direct access to SSC, from Interstate 10 and Interstate 59, is provided by Mississippi Highway 607, which passes through SSC. The highway is closed to the general public within the Fee Area (SSC 2005).

Approximately 13.7 km (8.5 mi) of canals inside the Fee Area are available to transport material, including large volumes of propellants and heavy cargo within SSC. The SSC canal system links to the East Pearl River through a lock system. The East Pearl River links SSC to the national waterway transportation system. It is 33.8 km (21 mi) from the main canal entrance to the Gulf Intracoastal Waterway (MSFC 1997a).

3.1.2.7.4 Public and Emergency Services

Fire protection at SSC is provided 24 hours per day for all areas and activities in the Fee Area. SSC has mutual aid agreements with landowner corporations in the Buffer Area and with several nearby municipalities whereby the fire fighting organizations of each entity agrees to lend equipment and personnel to one another when the need for assistance arises. Each county/parish in the area is currently serviced by law enforcement agencies. In addition to a medical facility at SSC, there are multiple hospitals and clinics in the surrounding county/parish area.

3.1.2.8 Cultural Resources

Three test stands at SSC, the A-1 Rocket Propulsion Test Stand (Building 4120), the A-2 Rocket Propulsion Test Stand (Building 4122), and the B-1/B-2 Rocket Propulsion Test Complex (Building 4220), have been designated as National Historic Landmarks (DOI 2007b).

The old Town of Gainesville, bounded by Fraizer Street, Blackman Street, Smyth Street, and the East Pearl River and located within the Fee Area, is NRHP-eligible and has been nominated for listing in the NRHP. The NASA-owned land within Logtown is eligible for listing in the NRHP.

3.1.2.9 Hazardous Materials and Waste

NASA maintains large-quantity status under RCRA Subtitle C at SSC for generating hazardous waste and having it transported offsite for treatment, storage, or disposal. Generating activities include research and development operations, facilities maintenance, construction, aerospace testing, cleaning and maintenance, equipment cleaning and degreasing, and photographic processes. Such wastes are disposed of offsite at certified hazardous waste disposal facilities by a licensed contractor. Six other agencies at SSC have small-quantity generator status, four of which are classified as "Conditionally Exempt" (NASA 2007a). All hazardous materials and waste are managed in accordance with applicable Federal, state, and local rules and regulations and the SSC plan for managing hazardous materials and waste.

Nonhazardous solid waste generated within the Fee Area is disposed of onsite in a permitted Class A solid waste landfill (number SW02401B0376). In 2005, the SSC landfill received

approximately 94,349 kg (208,000 lbs) of solid waste per month. A closed landfill is located southeast of the operating landfill at SSC (NASA 2007a).

3.1.3 Michoud Assembly Facility

MAF is a Government-owned, contractor-operated component of MSFC. MAF's primary activities involve the manufacturing of the Space Shuttle External Tank. For the Constellation Program, MAF would manufacture, assemble, and test components of the Orion Crew Module and Service Module and the Ares I Upper Stage. In addition, MAF is a candidate facility under consideration for the manufacture and assembly of the Ares V Core Stage and/or the Earth Departure Stage.

3.1.3.1 Land Resources

MAF operates on approximately 337 ha (833 ac) located in southeastern Louisiana, 25.7 km (16 m) east of downtown New Orleans (see Figure 3-6). MAF is within the boundaries of Orleans Parish in the eastern section of metropolitan New Orleans. MAF is bounded by the Gulf Intracoastal Waterway to the south, the Michoud Canal to the east, Old Gentilly Road to the north, and a commercial electricity generating facility and the New Orleans Fire Training Academy to the west (MAF 2006b).

Existing land use for MAF includes administration and management, offices and laboratories, services and support facilities, industrial/manufacturing and test areas, storage, open areas, and circulation and parking areas (see Figure 3-7). Approximately 60 percent of the buildings onsite are devoted to manufacturing activities, 20 percent are used for offices, and the remaining 20 percent are used as storage and support facilities. Most of the onsite development at MAF is located in the northeastern portion of the site and approximately 78 percent of the total site area is vacant land, consisting primarily of mowed grasslands and canals. MAF is also home to one of the largest manufacturing plants in the world with 17.4 ha (43 ac) under one roof (MAF 2006b).

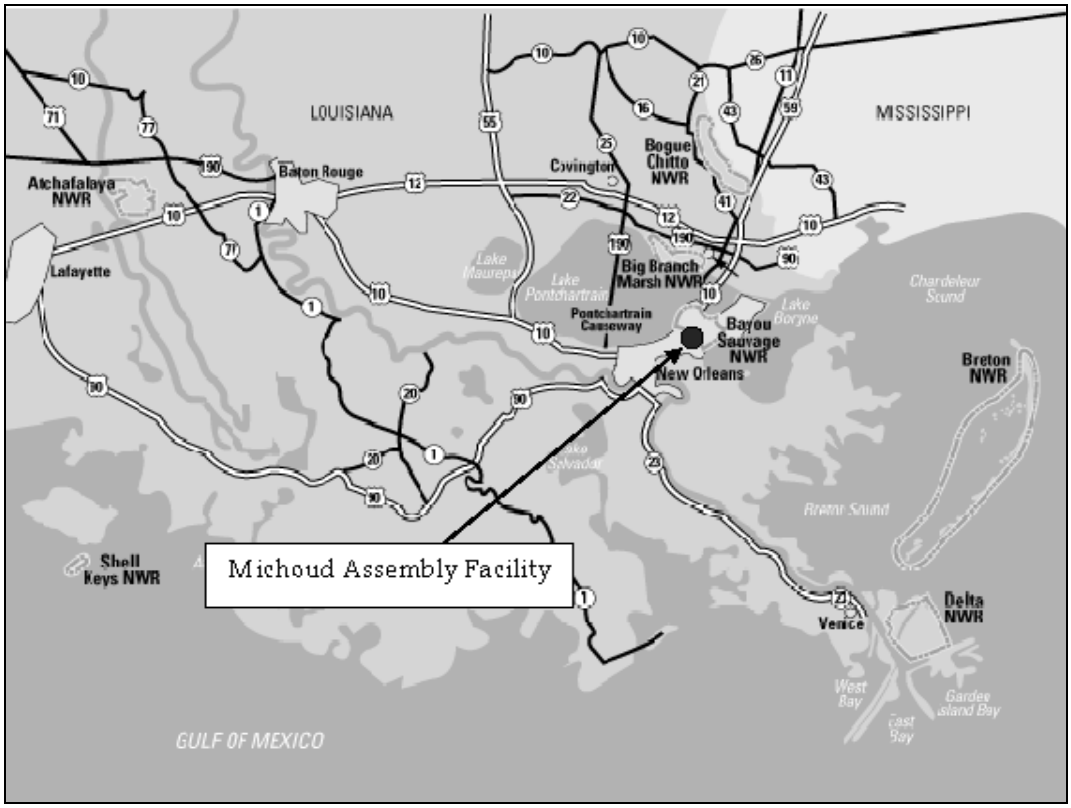
3.1.3.2 Air Resources

3.1.3.2.1 Climate

The climate at MAF can be classified as subtropical and humid with average annual temperatures ranging from 62 to 78.8°F (16.6 to 26°C). The average annual precipitation at MAF is 163 cm (64.2 in), and average humidity is approximately 76 percent. The average annual wind speed is 12.9 km per hour (8.0 mi per hour). Winds are predominantly from the south, but westerly and northerly winds are common during periods of hotter and drier weather (MAF 2006b).

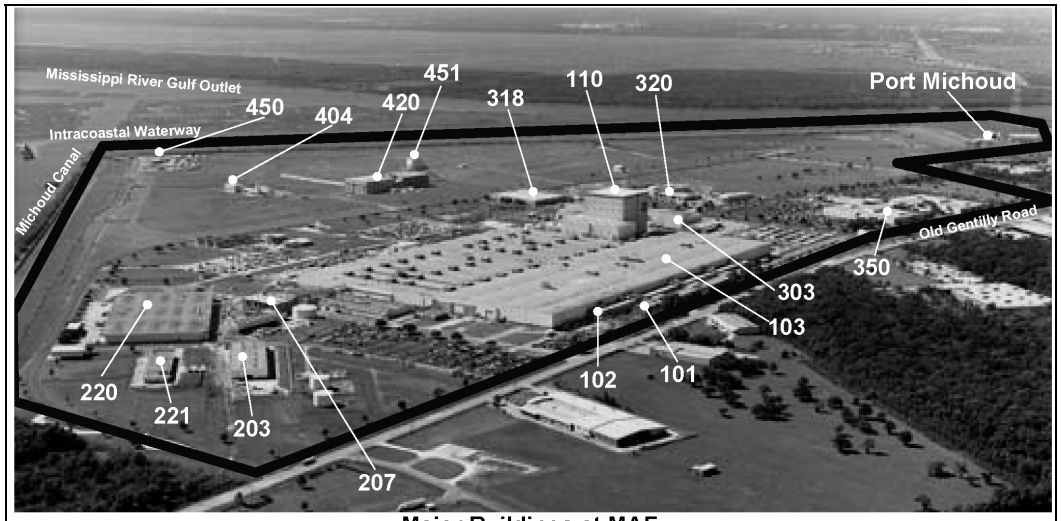
3.1.3.2.2 Air Quality

Air quality at MAF is regulated through the NAAQS promulgated under the CAA. See Section 3.1.1.2 for a discussion of primary and secondary air quality standards and criteria pollutants. The NAAQS for criteria pollutants have been adopted by the State of Louisiana.



Source: MAF 2006b

Figure 3-6. MAF Location and Vicinity Map



Major Buildings at MAF

101 Admin Bldg	203 Reclamation Storage	303 X-Ray Mod & Staging	404 Structures Test
102 Engr Bldg	207 Boiler House	318 Component Ablator Fac.	420 Acceptance & Prep
103 MFG Bldg.	220 Vehicle Component Supply Bldg	320 Facilities Ops. Bldg	450 Main Pumping Station
110 Vert Assy Bldg	221 Hazard Mats Storage	350 Office & Engr. Bldg	451 LH2 Pneumatic Test

Source: MAF 2006a

Figure 3-7. MAF Facilities Map

MAF does not operate under a CAA Title V permit. MAF currently has four Louisiana Department of Environmental Quality Air Emission Permits (NASA 2007a). Primary sources of air pollutants at MAF, other than mobile sources such as automobiles and construction equipment, include combustion sources (*e.g.*, boilers), production processes, and groundwater air strippers (MAF 2006b). New Orleans is classified as an attainment area for all criteria pollutants regulated under the NAAQS (EPA 2007c).

3.1.3.3 Water Resources

3.1.3.3.1 Potable Water

MAF receives its potable water supply from the Sewerage and Water Board of New Orleans. There are no active drinking wells at MAF or within 1.6 km (1 mi) of the site boundary (MAF 2006b).

3.1.3.3.2 Surface Water

MAF lies within the New Orleans coastal area of Southern Louisiana. In addition to being adjacent to the Michoud Slip, the Gulf Intercoastal Waterway, and the Michoud Canal, MAF is also located near the major water bodies of Lake Pontchartrain and Lake Borgne.

No natural streams or rivers pass through MAF and there are no rivers in the area that are designated as wild or scenic under the Wild and Scenic Rivers Act or designated as having the potential for inclusion under the Act. The nearest surface water body to MAF is the Michoud Canal (MAF 2006b).

MAF's drainage system is composed of open drainage ditches, catch basins, and underground pipes that deliver stormwater into the Borrow Canal. The Borrow Canal runs parallel to the flood protection levees that surround the facility to the east, south, and west. There is no natural surface drainage system within 305 m (1,000 ft) of MAF. Surface water is pumped from the Borrow Canal into the Michoud Canal under the authority of a Louisiana Discharge Elimination System Permit (number LA0052256) (NASA 2007a).

Most of the wastewater generated at MAF is associated with the manufacture of the Space Shuttle External Tank. Other operations, such as manufacturing support and research, developmental, and educational activities, generate minor amounts of wastewater. All wastewaters generated in production, quality control, laboratory research, and testing areas are discharged to the Industrial Wastewater Treatment Facility onsite for treatment before being discharged to the Borrow Canal under a Louisiana Department of Environmental Quality Wastewater Discharge Permit. Sanitary wastewater is collected in a separate system in a network of above and below-ground sewer lines and is treated at the Sewerage and Water Board of New Orleans' publicly owned treatment works. No treatment is performed before the discharge of utility waters to the onsite Borrow Canal (MAF 2006b).

Orleans Parish is included entirely within the coastal zone management boundary and, as such, must comply with the coastal zone management policy, which includes obtaining coastal use permits for specific activities (MAF 2006b).

Most of MAF is outside the 100-year flood plain. The industrial area at MAF is within the 500-year floodplain (MAF 2001). The hurricane storm surge that hit the MAF hurricane protection levees during Hurricane Katrina in 2005 caused some damage, although the flood damage was limited in comparison to the surrounding areas. There are no identified wetland areas within the MAF boundary (MAF 2006b).

3.1.3.3.3 Groundwater

MAF is underlain by four groundwater aquifers, including a semi-confined shallow (alluvial) aquifer, a confined 30.5-m (100-ft), 213-m (700-ft), and 366-m (1,200-ft) sand aquifers. There are no active drinking water wells at MAF or within 1.6 km (1 mi) of the site boundary, due to unsuitable shallow groundwater quality. In addition, there are no sole or principal drinking water aquifers in the area surrounding MAF. All of the aquifers, with the exceptions of the 213-m (700-ft) sand aquifer, do not meet drinking water standards.

MAF is involved with several RCRA corrective action projects regarding groundwater contamination. Remediation efforts to remove chlorinated organics are ongoing (MAF 2006b).

3.1.3.4 Ambient Noise

There is no source of excessive noise, sonic booms, or vibration originating from activities at MAF. Typical sources of noise at MAF include traffic and cooling towers. During peak traffic hours, noise levels are estimated to be between 70 and 74 dBA at 30 m (94.4 ft) from Old Gentilly Road. Cooling towers are estimated to have noise levels of between 85 and 100 dBA at 1 m (3.3 ft), and between 61 and 83 dBA at 15 m (49.2 ft). Furthermore, there is no population that is affected by these noise sources, as all manufacturing and office areas that are onsite and all residential areas offsite are very distant from these sources (MAF 2006b).

3.1.3.5 Geology and Soils

3.1.3.5.1 Geology

MAF is located on a flat area with minimal elevation change, ranging from 4.6 m (15 ft) above mean sea level on top of the flood protection levee along the Gulf Intercoastal Waterway to 0.6 m (2 ft) to 1.5 m (5 ft) above mean sea level along the northern edge of the site. Subsurface deposits at MAF typically consist of deltaic deposits of gravel, sand, silt, clay, and organic materials. There are at least 366 m (1,200 ft) of sediments beneath MAF. Bedrock beneath the facility consists of shale and sandstones. No active faults have been detected within 3.2 km (2 mi) of MAF. In addition, there are no known fractures or solution channels existing in the area (MAF 2006b).

3.1.3.5.2 Soils

The surface soils in the vicinity of MAF, where land forms are principally swamps, marsh, and natural levee, vary from highly organic to inorganic silts, highly plastic clays, lean clays, sandy silts, and minor amounts of sand. MAF is entirely located on reclaimed marshland, with surficial

materials composed entirely of constructed fill (a mixture of topsoil and river sand). No land within the boundaries of MAF is considered prime farmland (MAF 2006b).

MAF is involved with several RCRA corrective action projects regarding soil contamination. Past waste management disposal practices and accidents have contaminated soils with TCE, VOCs, metals, diesel fuel, and other contaminants. Remediation efforts are ongoing (MAF 2006b).

3.1.3.6 Biological Resources

The area surrounding MAF is primarily brackish coastal marsh, which has been extensively transformed by human development, and virtually all naturally occurring vegetation has been altered. A significant portion of MAF also has been altered from its natural state to support buildings, parking, and industrial operations. The undeveloped portions of MAF (approximately 263 ha [650 ac], or 78 percent of the site) consist primarily of manicured lawns, common weeds, shrubs, and trees. Although natural habitat is limited, MAF does support a variety of amphibian, reptile, bird, and mammal species. The aquatic biota in the freshwater reservoirs (*e.g.*, Borrow Canal) is reported to be plentiful and diverse. In addition, the area often is frequented by a large variety of birds due to the proximity of the Mississippi Flyway for migratory birds (MAF 2006b).

One critical habitat, described by the Louisiana Natural Heritage Program as a "submergent vascular vegetation (estuarine)" habitat, has been identified at MAF. This vegetation is located around the Michoud Slip (southwest corner of the site) and along the outer perimeter of the MAF levee system. This habitat is considered critical for the gulf sturgeon (MAF 2006b).

Although several threatened and endangered species could occur in the vicinity of MAF, the lack of appropriate habitat at MAF makes their presence onsite unlikely. Species that potentially could be transient at MAF include the federally protected bald eagle (*Haliaeetus leucocephalus*), the federally endangered brown pelican (*Pelecanus occidentals*), and the state protected American white pelican (*Pelecanus erythrorhynchos*) and diamond back terrapin (*Malaclemys terrapin*) (NASA 2007a).

3.1.3.7 Socioeconomics

This section addresses the existing socioeconomic conditions and characteristics in the MAF regional area. The MAF regional area is defined here as the New Orleans-Metairie-Kenner, LA Metropolitan Statistical Area, which includes Jefferson, Orleans, Plaquemines, St. Bernard, St. Charles, St. John the Baptist, and St. Tammany Parishes (USBC 2005).

3.1.3.7.1 Population

The total population within the MAF regional area was approximately 914,745 persons in 2006 (see Table 3-4). The total population is expected to increase to approximately 1,026,410 by 2010 and to approximately 1,099,270 by 2020. Similar increases are anticipated in Orleans Parish, where the total population was approximately 158,350 persons in 2006 and is expected to increase to approximately 248,320 by 2010 and to approximately 265,950 by 2020 (USBC 2000, USBC 2006a, USBC 2006b). The population of Orleans Parish is expected to rise rapidly through 2010, as the area continues to recover from Hurricane Katrina in 2005.

Table 3-4. Population of the MAF Regional Area and Orleans Parish for 2006, 2010, and 2020

Population	MAF Regional Area			Orleans Parish		
	2006	2010*	2020*	2006	2010*	2020*
White	604,025	637,798	661,575	44,497	69,342	71,927
Black or African American	262,542	330,667	364,582	106,572	168,176	185,425
American Indian and Alaska Native	3,588	3,897	4,357	317	499	558
Asian	19,062	22,922	28,969	3,642	5,914	7,474
Native Hawaiian and Other Pacific Islander	3	3	4	0	1	1
Some other race	11,891	13,244	14,900	1,425	2,258	2,540
Two or more races	13,209	—	—	2,059	—	—
Hispanic or Latino (of any race)	42,996	50,259	64,459	4,909	7,995	10,254
Total Population	**914,745**	**1,026,408**	**1,099,267**	**158,353**	**248,323**	**265,950**
Percent Minority	**33.97**	**37.86**	**39.82**	**71.90**	**72.08**	**72.95**

Sources: USBC 2000, USBC 2006a, USBC 2006b

* Projected population values for 2010 and 2020 do not represent absolute limits to growth; for any group, the future population may be above or below the projected value.

Note: Because an individual may report more than one race, the aggregate of the population groups may not match the total population.

In 2006, minority race populations represented approximately 34 percent of the total population within the MAF regional area and approximately 72 percent of the total population within Orleans Parish. The Black or African American population was the largest minority group living within the MAF regional area and Orleans Parish in the year 2006. Between 2006 and 2020, minority race populations are expected to increase to 40 percent of the total population within the MAF regional area and approximately 73 percent of the total population within Orleans Parish. The Black or African American population is estimated to remain the largest resident minority group within the MAF regional area and Orleans Parish in 2020 (USBC 2000, USBC 2006a, USBC 2006b).

3.1.3.7.2 Economy

Industrial sectors in the MAF regional area that provided significant employment include education, health, and social services; retail trade; arts, entertainment, recreation, accommodation, and food services; and professional, scientific, management, administrative, and waste management services. An estimated 409,155 people were employed in the MAF regional area in 2006 with an estimated unemployment rate of 5.6 percent (BLS 2007). The national and Louisiana unemployment rates during the same period were estimated at 4.6 and 4.3 percent, respectively (BLS 2007). The estimated percent of persons living below the poverty level (low-

income persons) in 2000 was as follows: U.S. – 12.4 percent, Louisiana – 19.6 percent, MAF regional area – 18 percent, and Orleans Parish – 27 percent (USBC 2006a).

MAF contributes significantly to the local, state, and national economies. MAF contributes more than $142 million in annual direct payroll and provides over $22 million in annual Louisiana subcontracts and more than $74 million annually in total contracts. The total annual estimated economic impact of MAF is $251 million (LDED 2006, MAF 2007). MAF also employs approximately 2,540 persons, making it one of the largest employers in New Orleans. The vast majority of MAF's workforce lives in St. Tammany Parish, followed by Orleans, Jefferson, and Pearl River Parishes. MAF also employs approximately 600 suppliers of goods and services in Louisiana (MAF 2007).

3.1.3.7.3 Transportation

MAF has fully developed infrastructure, including road access and all utilities to support its occupational needs. MAF is served by Interstate 10 with direct access from Old Gentilly Road or Paris Road. MAF is responsible for a major portion of the vehicular traffic on Old Gentilly Road (MAF 2006b).

Several freight and passenger railways serve the New Orleans area and provide access to virtually all of America's major markets. Surface water transportation is located immediately adjacent to MAF. MAF is located close to a domestic and international commercial airport (MAF 2006b).

3.1.3.7.4 Public and Emergency Services

Since Hurricane Katrina, the availability of hospitals has been limited. Six hospitals that are available to MAF personnel include four in Jefferson Parish and two in St. Tammany Parish, all less than 40 km (25 mi) away. MAF is provided police, fire, and health-related emergency and nonemergency services by plant personnel as well as by the city of New Orleans. The city maintains a police station and two fire stations within 8 km (5 mi) of MAF that serve MAF and the New Orleans East area (MAF 2006b).

3.1.3.8 Cultural Resources

There are no National Historic Landmarks and no facilities listed in the NRHP on MAF (DOI 2007a, DOI 2007b). However, there are five structures that would be associated with the Constellation Program which are eligible for the NRHP, including the Vertical Assembly Building (Building 110), High Bay Addition (Building 114), Acceptance and Preparation Building (Building 420), and the Pneumatic Test Facility and Control Building (Building 451 and Building 452) (MAF 2006b).

There are no archeological resources on MAF.

3.1.3.9 Hazardous Materials and Waste

MAF is classified as a large-quantity generator of hazardous waste, averaging more than 17,237 kg (38,000 lbs) of hazardous waste per month in 2005. MAF generates solid and hazardous waste from its research, development operations, laboratories, instrument repair, and operations and maintenance functions. Approximately 40 percent of the solid and hazardous waste streams come from processing the Space Shuttle External Tank. MAF is a permitted RCRA Part B treatment, storage, or disposal facility (MAF 2006b). All hazardous materials and waste are managed in accordance with applicable Federal, state, and local rules and regulations and the MAF plan for managing hazardous materials and waste.

MAF is involved with several RCRA corrective actions related to TCE contamination in groundwater and polychlorinated biphenyls (PCBs), chromium, and polynuclear aromatic hydrocarbons in the soil sediments (NASA 2007a).

All of MAF's nonhazardous waste is shipped offsite for treatment or disposal (MAF 2006b).

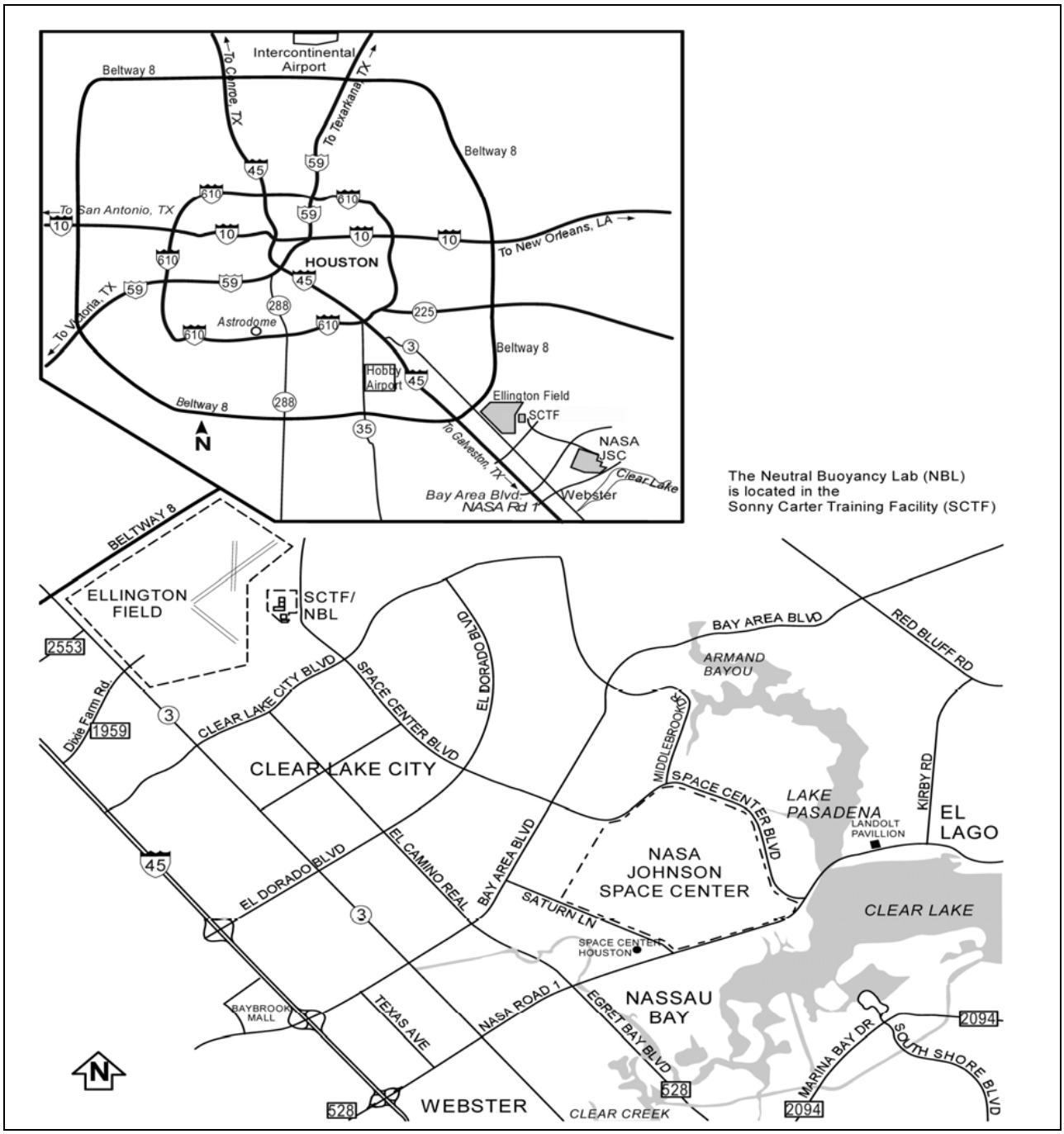
3.1.4 Lyndon B. Johnson Space Center

NASA's JSC is devoted to research, development, and mission planning and execution activities related to NASA's human space activities. JSC would have lead responsibility for managing the Constellation Program, as well as Project Orion, the Mission Operations Project, Lunar Lander Project, Extravehicular Activities Systems Project, and the Advanced Projects Office. JSC, through the Mission Operations Project, would lead all Constellation launch and atmospheric entry Range Safety activities, including management of all atmospheric entry Range Safety issues not within the boundaries of the landing sites.

3.1.4.1 Land Resources

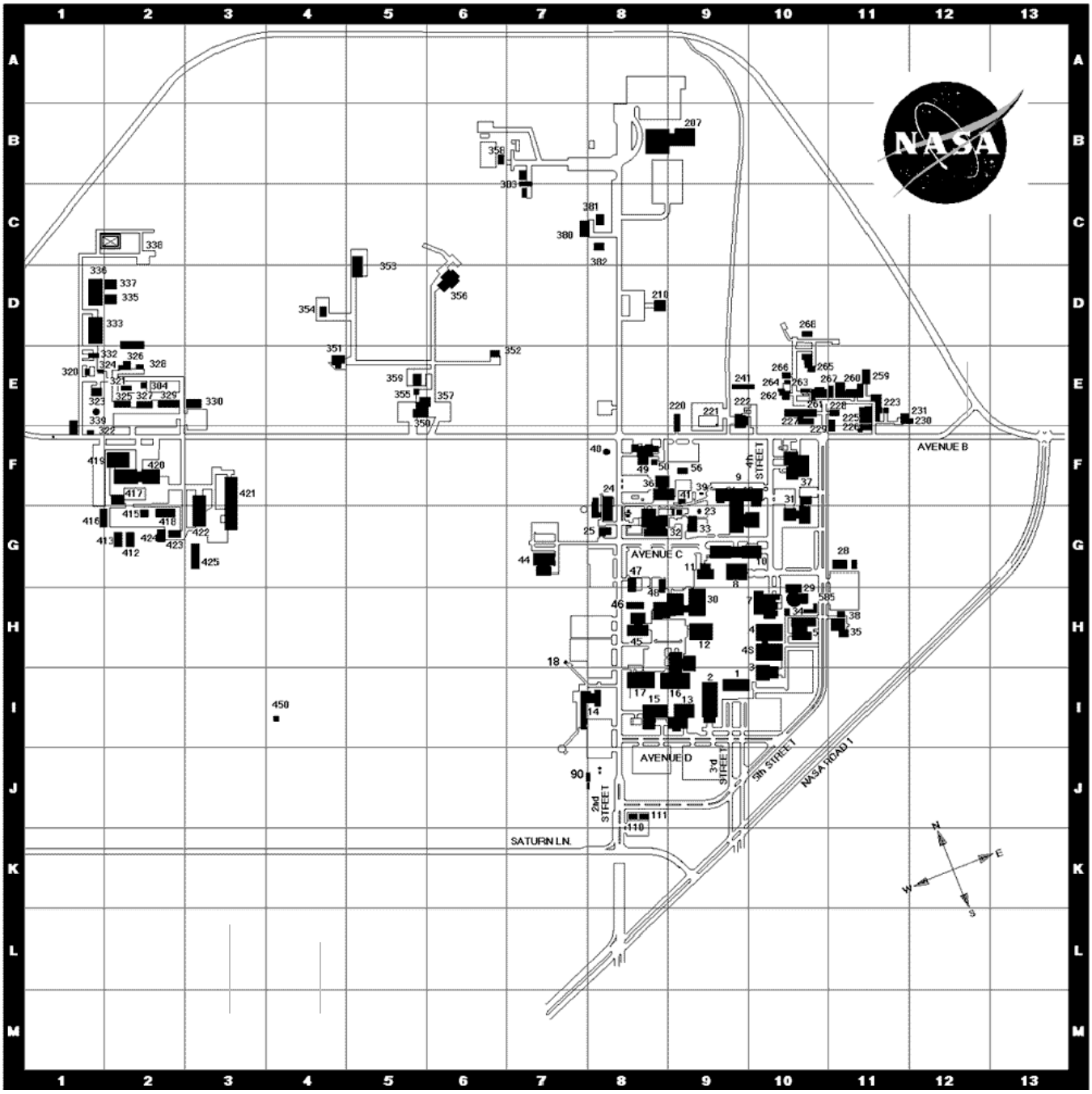
JSC is located in Harris County, Texas, approximately 40 km (25 mi) southeast of central Houston and 3 km (2 mi) northeast of Webster (see Figure 3-8). JSC adjoins public access areas, commercial and industrial sites, and residential areas of Clear Lake City. The Center encompasses approximately 640 ha (1,581 ac) of land and is the program management and operations center for the Space Shuttle and the Space Station programs. Basic and applied space research conducted at JSC includes propellant testing, development of communications devices, materials testing, lunar sample chemistry, physiological adaptation to microgravity, remote sensing, and space simulation. Land use at JSC is primarily commercial/industrial with more than 140 facilities, open space, utilities, and roads (see Figure 3-9). The southwestern portion of JSC is largely undeveloped and acts as a buffer zone. NASA also hosts more than a million visitors annually at the JSC visitors' center, Space Center Houston, to see displays on human space flight, crewed spacecraft, moon rocks, and space artifacts.

JSC also operates two satellite facilities, Ellington Field and Sonny Carter Training Facility, located 13 km (8 mi) and 8 km (5 mi) northwest of JSC, respectively (see Figure 3-8). Ellington Field is the center of aviation-related training operations for NASA's crewed space program and the Sonny Carter Training Facility is utilized for astronaut training operations (JSC 2006f, JSC 2006g).



Source: JSC 2005b

Figure 3-8. JSC Location and Vicinity Map



Source: JSC 2007i

Figure 3-9. JSC Facility Map

3.1.4.2 Air Resources

3.1.4.2.1 Climate

The climate at JSC can be classified as warm subtropical with hot summers and mild winters. Annual temperatures range from approximately 45 to 92°F (7 to 33°C). Average annual rainfall is approximately 117 cm (46 in) and the relative humidity is more than 50 percent most of the year. Winds are predominantly from the south and southwest (JSC 2004).

3.1.4.2.2 Air Quality

Air quality at JSC is regulated through the NAAQS promulgated under the CAA. See Section 3.1.1.2 for a discussion of primary and secondary air quality standards and criteria pollutants. The NAAQS for criteria pollutants have been adopted by the State of Texas.

JSC is classified as a major source of air emissions and operates under a CAA Title V permit (number 100665579) (TCEQ 2007). Sources of air pollutants at JSC, other than mobile sources such as automobiles and construction equipment, include combustion sources (*e.g.*, boilers), surface coating activities, laboratory hood vents, photograph processing, degreasing, woodworking, metal parts cleaning, and fugitive emissions due to chemical product usage at various locations (JSC 2004).

Harris County is currently designated as a moderate nonattainment area for the 8-hour ozone NAAQS (EPA 2007c).

3.1.4.3 Water Resources

3.1.4.3.1 Potable Water

JSC receives its potable water supply from the Clear Lake City Water Authority. Approximately 1.03 million kiloliters (kl) (272 million gal) of water are used annually at JSC (NASA 2007a).

3.1.4.3.2 Surface Water

JSC is set in a landscape with many tidal streams and estuaries of Galveston Bay. Clear Lake is southeast of JSC, Mud Lake (also known as Lake Pasadena) and Armand Bayou are to the northeast, Cow Bayou is to the southwest, and Horsepen Bayou is north of JSC. Galveston Bay is recognized by the EPA as an estuary of national significance and was included in the National Estuary Program in 1989. Armand Bayou is a coastal preserve in the Galveston Bay National Estuary Program. Armand Bayou and Clear Lake are classified by the Texas Natural Resources Conservation Commission as "water quality limited" and designated for contact recreation and high quality aquatic habitat (JSC 2004).

The Clear Lake watershed receives silt and urban runoff from JSC. Stormwater is drained from JSC by underground conduits and ditches. Most stormwater collects in four main ditches; two ditches discharge to Mud Lake and the other two ditches discharge to Cow Bayou and Horsepen Bayou. Clear Lake and ultimately Galveston Bay receive all drainage from JSC. JSC has a general permit for stormwater discharges from industrial activities (JSC 2004).

Wastewater generated at JSC includes domestic sewage, photographic rinse water, plating shop rinse water, laboratory wastewater, blowdown water from cooling towers, wastewater from the Energy Systems Test Area, and oily wastewater from the garage and shops. Most wastewaters from JSC operations flow in an underground sewer pipe to a wastewater treatment plant operated by the Clear Lake City Water Authority. Wastewaters that do not meet the standard for discharge to the sewer system are either pretreated or stored and transported to a permitted disposal facility offsite (JSC 2004).

The majority of JSC lies outside the 100- and 500-year floodplains. However, the eastern corner of JSC near the intersection of NASA Parkway and Space Center Boulevard and a section located along a tributary to Mud Lake in the northeastern portion of the Center lie within the 100- and 500-year floodplains. The USFWS and several independent site-specific surveys have identified at least 21 wetland areas at JSC (JSC 2004).

3.1.4.3.3 Groundwater

The Houston area is underlain by two important fresh water aquifers, the Chicot and the Evangeline. At JSC, the base of the Chicot aquifer is between 180 and 210 m (600 and 700 ft) below the surface, and the base of the Evangeline aquifer is between 790 and 910 m (2,600 and 3,000 ft) below the surface. The shallowest confined aquifer under JSC is a sand layer approximately 18 m (60 ft) below the surface. This aquifer is contained by a clay barrier layer at a depth of 26 m (85 ft). NASA monitors the quality of this aquifer four times per year (JSC 2004). The groundwater table is typically found approximately 2 to 3 m (8 to 11 ft) below the ground surface. The water table fluctuates with weather and may reach the ground surface during wet periods (JSC 2004).

Past activities at JSC have resulted in groundwater contamination. A plume of Freon® 113, caused by a leaky process sewer in 1987, which measures approximately 10 ha (25 ac) in area and is located about 20 m (60 ft) below the Energy Systems Test Area in the northwest part of the Center. Remediation efforts are ongoing; however JSC does not routinely use groundwater. Two water wells are maintained for contingency and emergency use only (JSC 2004).

3.1.4.4 Ambient Noise

There are six main noise sources at JSC. Three of these sources are utilities, including the Central Heating and Cooling Plant and cooling tower (Building 24), Auxiliary Chiller Facility and cooling tower (Building 28), and Emergency Power Building (Building 48). The other sources are the Vibration and Acoustic Test Facility (Building 49), the Atmospheric Reentry Materials and Structures Evaluation Facility (Building 222), and the Propulsion Test Facility (Building 353) (JSC 2004).

Sensitive receptors to JSC noise include the Child Care Facility (Building 210); the Gilruth Recreation Facility (Building 207); the Visitor Center (Building 90); and homes, stores, and offices outside JSC. Noise sources at JSC do not exceed typical conversation levels of 65 dBA at receptors outside the Center. The Child Care Facility receives up to 73 dBA discontinuously from noise sources. The Center evaluates and controls noise in work areas so that it will not cause loss of hearing or physical impairment (JSC 2004).

3.1.4.5 Geology and Soils

3.1.4.5.1 Geology

JSC is located on a fairly flat coastal plain of deep river silt deposits, with elevations ranging from 3 to 6 m (10 to 20 ft) above sea level. The coastal plain is latticed by nontectonic faults caused by earth movements. One hundred and thirty faults (active and inactive) extend over 300 km (200 mi) in Harris County; none of these faults cross JSC (JSC 2004).

3.1.4.5.2 Soils

JSC is on a nearly level plain of clayey and loamy prairie soils that drain poorly and allow only a small about of rain water to permeate to the groundwater. Without modification, these soils are considered poor building foundations because they shrink when dry and swell when wet (JSC 2004).

Sites of potential soil contamination include the sandblasting area near the Surplus Equipment Staging Warehouse (Building 338), the Fire Prevention Training Facility (Building 384), and the Energy Systems Test Area where contaminated groundwater currently is being treated to remove Freon® 113 (JSC 2004) (see Section 3.1.4.3 for more details).

3.1.4.6 Biological Resources

JSC is located in the Upper Coastal Prairie Grasslands of the Gulf Prairies and Marshes biogeographic area of the State of Texas. The region includes salt grass marshes surrounding bays and estuaries, and tall woodlands in the river bottomlands. Most of JSC is too highly disturbed to support a significant number of indigenous Texas plant species. Many of the native plant species have been replaced with cultivated turf, ornamental shrubs, and trees. The remaining open grasslands in the undeveloped areas and around some buildings are mowed semi-annually (JSC 2004).

The Upper Texas Gulf Coast, including JSC, is home to many species of birds, mammals, reptiles, and amphibians. However, agriculture and urban development have fragmented and degraded wildlife habitat. Homes, shops, and office buildings surround JSC on all but its north and northeast boundaries, which abut Armand Bayou Nature Center, a 750-ha (1,900-ac) nature preserve with undisturbed wildlife habitat. Most of JSC is kept open, with little cover and food for wildlife. In the developed areas, traffic and routine activities also discourage wildlife (JSC 2004).

No threatened or endangered species and no critical habitats for state or federally threatened or endangered species are known to exist at JSC (JSC 2004).

3.1.4.7 Socioeconomics

This section addresses the existing socioeconomic conditions and characteristics in the JSC regional area. The JSC regional area is defined here as the land area within an 80.5-km (50-mi) radius of JSC, which includes Galveston, Chambers, Brazoria, Fort Bend, Harris, Liberty, and portions of Montgomery, Waller, and Jefferson Counties (USBC 2006a).

3.1.4.7.1 Population

The total population within the JSC regional area was approximately 4,411,230 persons in 2000 (see Table 3-5) (USBC 2006a). The total population is expected to increase to approximately 5,133,320 by 2010 and to approximately 5,922,450 by 2020. Similar increases are anticipated in Harris County where the total population was approximately 3,400,580 persons in 2000 and is expected to increase to approximately 3,957,230 by 2010 and to approximately 4,565,560 by 2020 (USBC 2000).

Table 3-5. Population of the JSC Regional Area and Harris County for 2000, 2010, and 2020

Population	JSC Regional Area			Harris County		
	2000	2010*	2020*	2000	2010*	2020*
White	2,710,433	3,029,430	3,363,786	1,997,123	2,232,169	2,478,532
Black or African American	766,582	919,294	1,081,483	628,619	753,847	886,847
American Indian and Alaska Native	19,482	24,556	29,934	15,180	19,133	23,324
Asian	226,350	305,040	385,450	174,626	235,334	297,370
Native Hawaiian and Other Pacific Islander	2,466	3,323	4,199	2,095	2,823	3,568
Some other race	562,982	703,422	862,426	482,283	602,592	738,804
Two or more races	122,939	—	—	100,652	—	—
Hispanic or Latino (of any race)	1,311,421	1,654,537	2,056,147	1,119,751	1,412,719	1,755,632
Total Population	**4,411,234**	**5,133,319**	**5,922,454**	**3,400,578**	**3,957,226**	**4,565,563**
Percent Minority	**38.56**	**40.98**	**43.20**	**41.27**	**43.59**	**45.71**

Sources: USBC 2000, USBC 2006a

* Projected population values for 2010 and 2020 do not represent absolute limits to growth; for any group, the future population may be above or below the projected value.

Note: Because an individual may report more than one race, the aggregate of the population groups may not match the total population.

In 2000, minority race populations represented approximately 39 percent of the total population within the JSC regional area and approximately 41 percent of the total population within Harris County. Hispanic or Latino (of any race) population was the largest minority group living within the JSC regional area and Harris County in the year 2000. Between 2000 and 2020, minority race populations are expected to increase to 43 percent of the total population within the JSC regional area and approximately 46 percent of the total population within Harris County. The Hispanic or Latino (of any race) population is estimated to remain the largest resident minority group within the JSC regional area and Harris County in 2020 (USBC 2000, USBC 2006a).

3.1.4.7.2 Economy

Industrial sectors in the JSC regional area that provide significant employment include education, health, and social services; manufacturing; professional, scientific, management,

administrative, and waste management services; and retail trade. An estimated 3,267,177 people were employed in the JSC regional area in 2000 with an estimated unemployment rate of 6.8 percent. The national and Texas unemployment rates during the same period were estimated at 5.8 and 6.1 percent, respectively. The estimated percent of persons living below the poverty level (low-income persons) in 2000 was as follows: U.S. – 12.4 percent, Texas – 15.4 percent, JSC regional area – 13.6 percent, and Harris County – 14.8 percent (USBC 2006a).

JSC contributes significantly to the local, state, and national economies. The aerospace industry, centered on JSC, brings billions of dollars in NASA contracts to the area every year. JSC's combined workforce accounts for 16,844 jobs, and is made up of 3,076 civil servants and 13,768 support contractors (BAHEP 2007). The vast majority of JSC's workforce lives in Clear Lake City, followed by the communities of League City, Friendswood, Nassau Bay, and Seabrook/El Lago/Taylor Lake Village. The total economic impact from JSC on the City of Houston and Texas includes more than 26,435 jobs with personal incomes of more than $2.5 billion and total spending that exceeds $3.5 billion (BAHEP 2007).

3.1.4.7.3 Transportation

JSC has fully developed infrastructure, including road access and all utilities to support its occupational needs. Transportation to JSC for most employees is provided via private motor vehicle along State Highway 3, State Highway 146, and Interstate 45. JSC is connected to the local roadway system by NASA Parkway to the south, Space Center Boulevard to the north and east, and Saturn Boulevard to the west. Traffic on NASA Parkway is generally congested during morning and afternoon rush hours.

Bus shuttles to JSC are available from select locations. JSC does not have direct rail service; however, air freight and commercial flight services are within a short drive from JSC. In addition, the Port of Houston and Port of Galveston serve outgoing ships and provide worldwide cargo service.

3.1.4.7.4 Public and Emergency Services

Fire protection at JSC is contracted with the city of Houston fire department, and police protection is provided by a NASA security service. Neighboring city and county police and fire departments would provide additional assistance during an emergency. Health services in the Clear Lake area are adequate to handle JSC's employees and the surrounding communities.

3.1.4.8 Cultural Resources

The Apollo Control Room within the Mission Control Center (within Building 30) and the Space Environment Simulation Laboratory, Chambers A and B (Building 32), are designated National Historic Landmarks (DOI 2007a, DOI 2007b).

Facilities at JSC that would be associated with the Constellation Program and are eligible for individual listing in the NRHP include the Jake Garn Mission Simulator and Training Facility (Building 5), Crew Systems Laboratory (Building 7), Systems Integration Facility (Building 9), Mission Control Center, Space Environment Simulation Laboratory (Building 32),

Communications and Tracking Development Laboratory (Building 44), and the Neutral Buoyancy Lab (Building 920N), located at the Sonny Carter Training Facility.

There are no known archeological resources associated with Constellation Program activities.

3.1.4.9 Hazardous Materials and Waste

JSC uses hazardous materials for various research activities, which in turn generate hazardous wastes. NASA is regulated both for generation, treatment, and storage of hazardous wastes at JSC, for which it holds a RCRA Part B permit. In addition, NASA has registered its hazardous and industrial wastes generated at JSC with the Texas Natural Resource Conservation Commission (JSC 2004). In 2005, JSC generated 88,241 kg (194,535 lb) of hazardous wastes. Such wastes are disposed of offsite at certified hazardous disposal facilities by a licensed contractor. Furthermore, all hazardous materials and waste are managed in accordance with applicable Federal, state, and local rules and regulations and JSC's plan for managing hazardous materials and waste (JSC 2004).

Nonhazardous wastes are sent to the city of Houston landfill and some classified wastes (*e.g.*, paper, microfilm, and microfiche) are incinerated onsite. Several closed and graded landfills are located at JSC (JSC 2004).

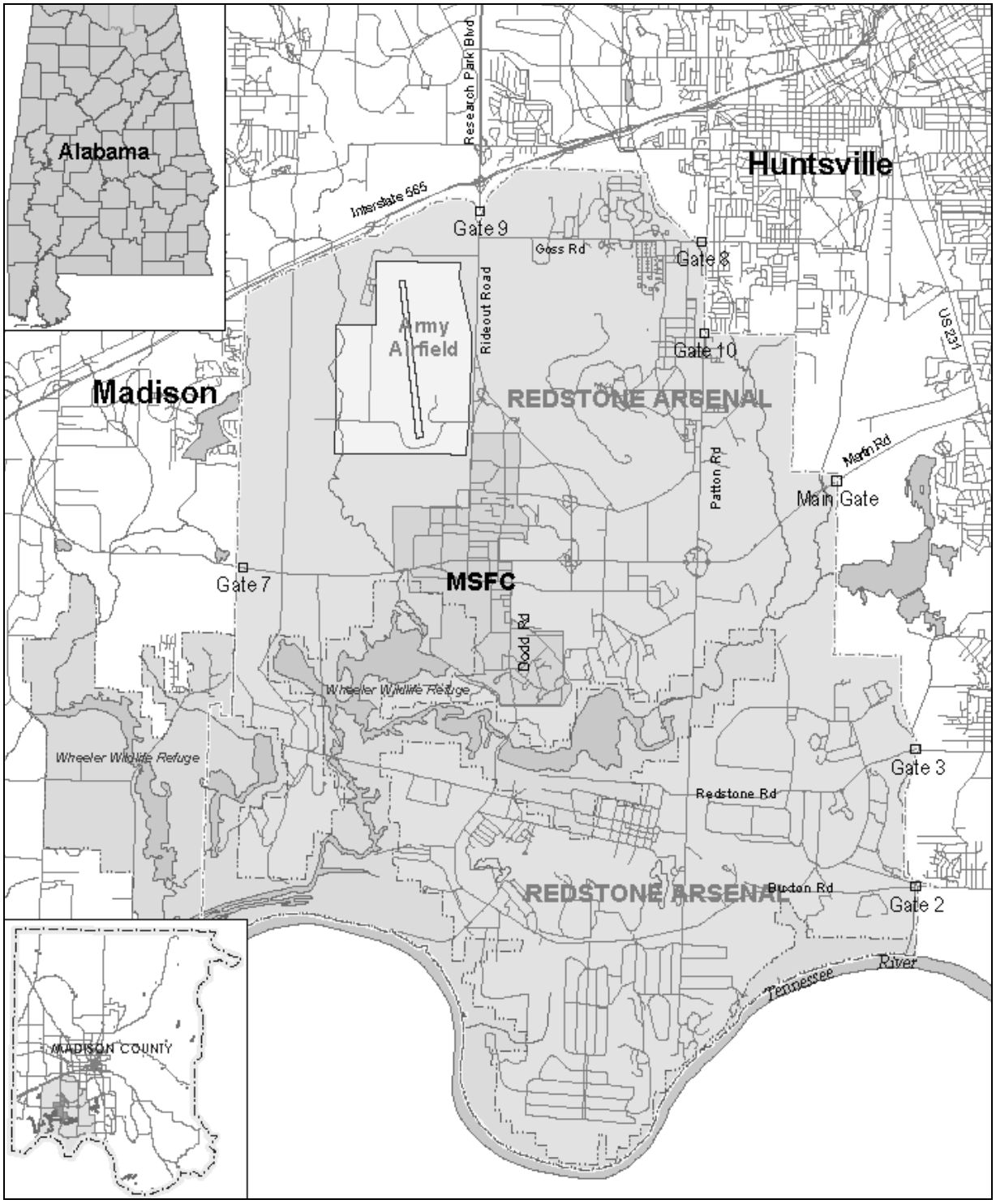
3.1.5 George C. Marshall Space Flight Center

MSFC is NASA's principal propulsion research center. The Center supports the design and development of the major space transportation systems, orbital systems, and scientific and applications payloads for space exploration. For the Constellation Program, MSFC would manage Project Ares.

3.1.5.1 Land Resources

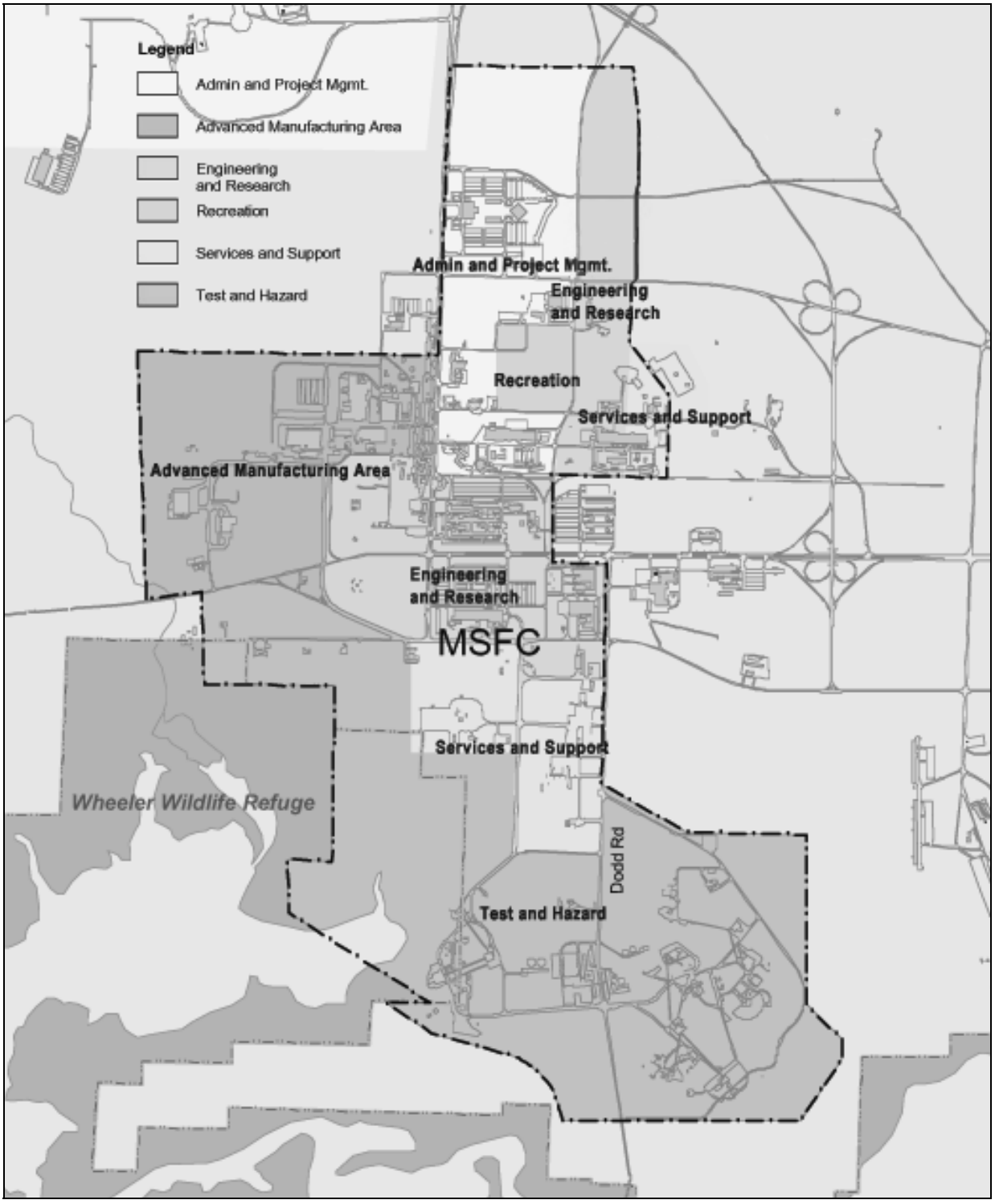
MSFC is located on approximately 745 ha (1,841 ac) within the grounds of the U.S. Army Redstone Arsenal, southwest of the city of Huntsville, Alabama (see Figure 3-10). Redstone Arsenal occupies 15,503 ha (38,309 ac) in the southwestern portion of Madison County, Alabama. MSFC is almost centrally located within Redstone Arsenal, which provides a 4- to 11.3-km (2.5- to 7-mi) buffer zone between the engine test stands and the general public. A substantial portion of Redstone Arsenal, including most of the lands to the south and west of MSFC, is a part of the Wheeler National Wildlife Refuge. Approximately 73 ha (180 ac) of the Wheeler National Wildlife Refuge extends onto property controlled by MSFC. The southern boundary of Redstone Arsenal is formed by the Tennessee River. The city of Huntsville surrounds Redstone Arsenal on the east, north, and much of the west sides (MSFC 2002b).

Land use at MSFC consists primarily of administration and management office space, engineering and research laboratories, services and support facilities, industrial/manufacturing and engine test areas, recreational and open areas, and roadway and parking areas (see Figure 3-11). The wide array of facilities at MSFC are capable of simulating the space environment; testing large propulsion systems; and developing new materials, hardware, and procedures. Test facilities are generally located in the southern portion of MSFC (MSFC 2002a).



Source: MSFC 2002a

Figure 3-10. MSFC Location and Vicinity Map



Source: MSFC 2002a

Figure 3-11. MSFC Land Use Map

3.1.5.2 Air Resources

3.1.5.2.1 Climate

The climate at MSFC can be classified as temperate with warm and humid summers and cool winters with average annual temperatures ranging from 40 to 79°F (4 to 26°C). The average annual precipitation at MSFC is 137 cm (52 in), and the average relative humidity is more than 70 percent (MSFC 2002a).

3.1.5.2.2 Air Quality

Air quality at MSFC is regulated through the NAAQS promulgated under the CAA. See Section 3.1.1.2 for a discussion of primary and secondary air quality standards and criteria pollutants. The State of Alabama and the city of Huntsville have adopted the NAAQS.

MSFC is classified as a major source of air emissions and operates under a CAA Title V permit (number 0108900014). Sources of air emissions at MSFC include boilers, internal combustion engines, propulsion engine and launch vehicle system testing, pipe cleaning, air strippers, sand blasting, and grit blasting (MSFC 2006a). The Huntsville/Madison County area is classified as an attainment area for all criteria pollutants regulated under the NAAQS (EPA 2007c).

3.1.5.3 Water Resources

3.1.5.3.1 Potable Water

MSFC obtains its water supply (industrial and potable) from the Redstone Arsenal water supply system which uses the Wheeler Reservoir of the Tennessee River as a source. In 2005, MSFC used approximately 2.19 million kl (575 million gal) of water and treated 14,820 kl (3.9 million gal) of wastewater (MSFC 2006a).

3.1.5.3.2 Surface Water

Surface water is abundant in Madison County. MSFC is located within the boundaries of the Indian Creek and Huntsville Spring Branch Drainage Basin and approximately three miles north of the Tennessee River. Most surface water drainage within MSFC is through constructed ditches to intermittent and perennial streams flowing west and southwest into tributaries of Indian Creek, or south and southeast into tributaries of Huntsville Spring Branch, both of which eventually discharge to the Tennessee River (MSFC 2002a).

Section 303(d) of the Clean Water Act (CWA) requires states to identify waters that are impaired by pollution, even after application of pollution controls. For those waters, states must establish a total maximum daily load (TMDL) of pollutants to ensure that water quality standards can be attained. The Tennessee River was a CWA 303(d) listed water for pH and thermal modifications. This water body was delisted in 2002. Huntsville Spring Branch was a CWA 303(d) listed water for metals and priority organics as parameters of concern. The TMDL for priority organics was finalized in 2003. Huntsville Spring Branch was delisted for metals in 2003. Indian Creek is a CWA 303(a) listed water for organic enrichment, dissolved oxygen, siltation, and priority organics. The TMDL for priority organics was finalized in 2003 and the

TMDLs for organic enrichment/dissolved oxygen and siltation were finished in 2002 (MSFC 2006a).

MSFC operates under an NPDES permit (number AL0000221) that specifies discharge limitations and monitoring requirements for multiple outfalls at MSFC. The majority of these outfalls discharge stormwater and/or process water. Wastewater generated at MSFC generally consists of noncontact cooling water, discharge from floor drains and laboratory sinks, cooling water and boiler blowdowns, photographic and plating wastewaters, and above-ground storage tank dike draining. Wastewater discharged to the sanitary sewer is treated prior to discharge into the river at Redstone Arsenal's water treatment plant. Domestic sewage is primarily treated at Redstone Arsenal and discharged to the Tennessee River. Certain areas, particularly the test areas, use septic tanks and disposal fields for sewage treatment (MSFC 2002a).

A significant portion of MSFC is within the 100-year floodplain and subject to flooding by the Tennessee River. There are no areas near MSFC that are designated within the 500-year floodplain. Twenty-four wetlands have been identified on MSFC as palustrine systems and either scrub-shrub, forested, emergent, or open water systems (MSFC 2002a). Less than 10 percent of MSFC is considered wetlands (MSFC 1997a).

3.1.5.3.3 Groundwater

Two aquifers or layers of groundwater are present near the surface at MSFC. The first layer, the Residuum Aquifer, includes soil and unconsolidated material from the surface to the bedrock. The residuum serves as a large groundwater reservoir. The second layer of groundwater, the Tuscumbia limestone/Fort Payne Aquifer, is characterized by an intricate network of cavities along bedding, joint, and fracture planes through which groundwater can readily flow. The Tuscumbia limestone/Fort Payne is the primary aquifer in the region for water supply (MSFC 2002a).

In 1994, MSFC was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 42 U.S.C. §§ 9601-9675) National Priorities List. Activities at MSFC and Redstone Arsenal have resulted in large areas of contaminated groundwater (*e.g.*, chlorinated volatile organic compounds, tetrachloroethene [PCE], trichloroethene [TCE], dichloroethene [DCE], vinyl chloride, carbon tetrachloride [CTC], chloroform, and 1,1,2,2-tetrachloroethane [1,1,2,2-PCA]). In addition, a small benzene, toluene, ethyl benzene, and xylene plume is located at the former base refueling area. Contaminated groundwater plumes are believed to discharge to springs located south and west of MSFC. Remediation activities are ongoing (MSFC 2002a).

3.1.5.4 Ambient Noise

MSFC is surrounded by a large federally owned area consisting of the Redstone Arsenal and the Wheeler National Wildlife Refuge. This area is an effective physical barrier between MSFC testing activities and the general public. The U.S. Army has been developing and testing rocket engines at Redstone Arsenal since shortly after the end of World War II. Development and testing of space propulsion systems has been the primary mission of MSFC since its

establishment in 1960, and significant engine testing has occurred during the last 40 years (MSFC 1997a).

Several populated areas surround Redstone Arsenal, including Huntsville to the east, north, and west; Madison to the west-northwest; Triana to the southwest; Mooresville to the west; Somerville and Hartselle to the southwest; Decatur to the west-southwest; and Falkville to the south-southwest. The nearest public dwellings to the test facilities at MSFC are approximately 4 km (2.5 mi) along the western boundary of Redstone Arsenal. A child day care center is located within MSFC, 2.5 km (1.5 mi) from the test facilities (MSFC 1997a).

3.1.5.5 Geology and Soils

3.1.5.5.1 Geology

MSFC lies on a gently rolling area, with elevations ranging from 171 to 198 m (560 to 650 ft) above mean sea level. MSFC is underlain by thin to thick beds of coarsely-crystalline, dark to light gray fossiliferous limestone, with some interbedded layers of gray chert. The formation also contains layers of dark gray, fine-grained limestone. The limestone formation has an average thickness of 46 m (150 ft). The area is considered to have low to moderate seismicity with no known active earthquake faults (MSFC 2002a).

3.1.5.5.2 Soils

MSFC is covered by soils consisting of generally well-drained, red, fertile, silty clay loams, and silt loams that are typically associated with level to gently rolling terrain. These soils are composed primarily of insoluble residue produced by chemical weathering of the underlying limestone. In addition, these soils are of variably low to high plasticity, with lenses of silty or sandy clay (MSFC 2002a).

Previous activities at MSFC and Redstone Arsenal have resulted in areas of soil contamination (*e.g.*, polyaromatic hydrocarbons, metals, PCBs, pesticides, and chlorinated solvents), which are managed under CERCLA (MSFC 2002a) (see Section 3.1.5.3 for more detail).

3.1.5.6 Biological Resources

MSFC is located in a region that is rich in biological diversity associated with an abundance of animal and plant communities. The region's dominant vegetation is mixed pine and hardwood forests interspersed with pasture and fallow and abandoned cropland in various stages of regrowth. Within MSFC, nearly half the land area is developed. The remaining undeveloped areas support mostly forests, fields, and marshes in various stages of ecological succession. In upland areas, forest cover includes stands of planted pines such as loblolly, short leaf, Virginia, slash pine, and stands of pines mixed with hardwoods such as various oaks, black walnut, and hickories. Bottomland hardwoods are found in transition and low-lying areas (MSFC 1997a).

MSFC also supports a variety of wildlife species, including whitetail deer, opossum, beaver, mink, and various waterfowl. The most sensitive natural habitats at MSFC are those adjacent to

the test areas in the Wheeler National Wildlife Refuge, which is a major waterfowl wintering area and year-round habitat for many species (MSFC 1997a).

Few aquatic habitats exist at MSFC. With the exception of undeveloped wetlands comprising less than 10 percent of MSFC in the southwest portion of the site, and small segments of Indian Creek on the MSFC western boundary, most aquatic habitats are ephemeral (not permanent) and exist only during the wet portions of the year or in response to heavy rain events (MSFC 1997a).

There are four federally threatened and endangered species that could occur on MSFC and Redstone Arsenal, including the Alabama cave shrimp (*Palaemonias alabamae*), gray bat (*Myotis grisescens*), Indian bat (*Myotis sodalis*), and Price's potato bean (*Apios priceana*). The federally protected bald eagle (*Haliaeetus leucocephalus*) could also occur at MSFC. The Southern Cave Fish (Typhlichthys *subterraneus*) and Green Salamander (*Aneides geneus*) are state-protected species that could occur at MSFC. A site survey has been conducted which did not reveal any protected species onsite (MSFC 2002b).

3.1.5.7 Socioeconomics

This section addresses the existing socioeconomic conditions and characteristics in the MSFC regional area. The MSFC regional area is defined here as the land area within an 80.5-km (50-mi) radius of MSFC, which includes Marshall, Morgan, Limestone, Madison, Cullman, Jackson, and portions of Lauderdale, Colbert, Franklin, DeKalb, Etowah, Blount, and Winston Counties in Alabama and Lincoln, Giles, Moore, and portions of Lawrence, Marshall, Bedford, and Franklin Counties in Tennessee (USBC 2006a).

3.1.5.7.1 Population

The total population within the MSFC regional area was approximately 862,360 persons in 2000 (see Table 3-6) (USBC 2006a). The total population is expected to increase to approximately 929,410 by 2010 and to approximately 988,450 by 2020. Similar increases are anticipated in Madison County, where the total population was approximately 276,700 persons in 2000 and is expected to increase to approximately 298,215 by 2010 and to approximately 317,160 by 2020 (USBC 2000).

In 2000, minority race populations represented approximately 16 percent of the total population within the MSFC regional area and approximately 28 percent of the total population within Madison County. The Black or African American population was the largest minority group living within the MSFC regional area and Madison County in the year 2000 (USBC 2000, USBC 2006a). Between 2000 and 2020, minority race populations are expected to increase to 17 percent of the total population within the MSFC regional area and approximately 29 percent of the total population within Madison County. The Black or African American population is estimated to remain the largest resident minority group within the MSFC regional area and Madison County in 2020 (USBC 2000, USBC 2006a).

Table 3-6. Population of the MSFC Regional Area and Madison County for 2000, 2010, and 2020

Population	MSFC Regional Area			Madison County		
	2000	2010*	2020*	2000	2010*	2020*
White	725,487	778,581	822,026	199,401	213,994	225,935
Black or African American	101,445	109,491	117,569	63,025	68,023	73,042
American Indian and Alaska Native	7,212	7,602	8,593	2,129	2,244	2,537
Asian	6,751	8,700	10,386	5,140	6,624	7,908
Native Hawaiian and Other Pacific Islander	375	483	577	158	204	243
Some other race	8,655	9,433	10,223	1,629	1,775	1,924
Two or more races	12,435	—	—	5,218	—	—
Hispanic or Latino (of any race)	21,615	27,037	33,114	5,226	6,537	8,006
Total Population	**862,360**	**929,414**	**988,451**	**276,700**	**298,215**	**317,158**
Percent Minority	**15.87**	**16.23**	**16.84**	**27.94**	**28.24**	**28.76**

Sources: USBC 2000, USBC 2006a

* Projected population values for 2010 and 2020 do not represent absolute limits to growth; for any group, the future population may be above or below the projected value.

Note: Because an individual may report more than one race, the aggregate of the population groups may not match the total population.

3.1.5.7.2 Economy

Industrial sectors in the MSFC regional area that provide significant employment include manufacturing; educational, health, and social services; retail trade; construction; and professional, scientific, management, administrative, and waste management services. An estimated 671,067 people were employed in the MSFC regional area in 2000 with an estimated unemployment rate of 5.4 percent. The unemployment rate for Madison County was 5.7 percent. The national and Alabama unemployment rates during the same period were estimated at 5.8 and 6.2 percent, respectively. The estimated percent of persons living below the poverty level (low-income persons) in 2000 was as follows: U.S. – 12.4 percent, Alabama – 16.1 percent, MSFC regional area – 12.2 percent, and Madison County – 10.3 percent (USBC 2006a).

MSFC contributes significantly to the local, state, and national economies. In fiscal year 2006, MSFC had an operating budget of $2.26 billion and contributed $302 million in payroll expenditures. MSFC employed approximately 2,533 civil servants and 4,422 support contractors in 2006 (MSFC 2007c). The vast majority of MSFC's workforce lives in Madison County, followed by Morgan and Limestone Counties (MSFC 2007b).

3.1.5.7.3 Transportation

MSFC has fully developed infrastructure, including road access and all utilities to support its occupational needs. MSFC and Huntsville are served directly by U.S. Highways 72, 72A, 231, and 431. Access to Interstate 65, approximately 24 km (16 mi) west of MSFC, is by way of U.S. 72, U.S. 72A, and Interstate 565 (MSFC 1997a). Local bus service is available for commuters (MSFC 2002a).

MSFC has direct access to low-cost, deep-water transportation via the Tennessee-Tombigbee Waterway and the Tennessee/Ohio/Mississippi River System, including barge-loading docks on the adjacent Redstone Arsenal and a supporting road system to handle very large cargo (MSFC 1997a). Use of rail facilities at Redstone Arsenal was largely discontinued in the early 1970s. Most of the track has been removed, and only a small section of rail remains on Redstone Arsenal. A railhead located near the north boundary has been retained to serve MSFC as the need arises (MSFC 2002a).

MSFC is located approximately 16 km (10 mi) east of the Huntsville International Airport and the International Intermodal Center, a regional air, rail, and highway transportation center (MSFC 2002a).

3.1.5.7.4 Public and Emergency Services

Twenty-four-hour firefighting services, including personnel and equipment, are provided to MSFC by four fire stations owned and operated by the U.S. Army. In addition, MSFC has a mutual aid agreement with the city of Huntsville fire department for firefighting assistance, as well as a working agreement with all northern Alabama fire stations. Security guards under contract with MSFC are in charge of law enforcement duties. Numerous regional medical centers, including a clinic at MSFC and Redstone Arsenal, meet community medical needs (MSFC 2002a).

3.1.5.8 Cultural Resources

Facilities at MSFC that would be associated with the Constellation Program and are designated as National Historic Landmarks include the Propulsion and Structural Test Facility (Building 4572), Structural Dynamic Test Facility (Building 4550), and Multi-purpose High Bay and Neutral Buoyancy Simulator Complex (Building 4705) (DOI 2007b).

Facilities at MSFC that would be associated with the Constellation Program and are eligible for individual listing in the NRHP include the Hardware Simulation Laboratory (Building 4436), Avionics Systems Testbed (Building 4476), Test Facility 116 (Building 4540), Test Stand 116 (Building 4540), Hot Gas Test Facility (Building 4554), Structural Dynamic Test Facility (Building 4550), Test and Data Recording Facility (Building 4583), Materials and Processes Laboratory (Building 4612), Structures and Mechanics Laboratory (Building 4619), Huntsville Operations Support Center (Building 4663), Advanced Engine Test Facility (Building 4670), Multi-purpose High Bay and Neutral Buoyancy Simulator (Building 4705), National Center for Advanced Manufacturing (Building 4707), Engineering and Development Laboratory (Building 4708), and the Wind Tunnel Facility (Building 4732).

There are no known archeological resources associated with Constellation Program activities.

3.1.5.9 Hazardous Materials and Waste

MSFC is classified as a large-quantity generator of hazardous waste and is managed under RCRA Subtitle C. Generating activities at MSFC include vehicle maintenance, research and development activities, and industrial activities. During 2005, MSFC generated 26,779 kg (59,036 lbs) of hazardous waste and 28,113 kg (61,978 lbs) of controlled waste (MSFC 2006a). These wastes include cadmium, chromium, lead, and other metals; wastes that exhibit the characteristics of ignitability, corrosiveness, or reactivity; lab packs of small amounts of hazardous waste; spent solvents; and wastewater treatment sludge. All hazardous materials and waste are managed in accordance with applicable Federal, state, and local rules and regulations and the MSFC plan for managing hazardous materials and waste. Hazardous wastes are disposed of offsite at certified hazardous disposal facilities by a licensed contractor (MSFC 1997a).

MSFC was placed on the CERCLA National Priorities List in 1994 (NASA 2007a) (see Section 3.1.5.3 for more detail). NASA submits annual reports under the EPCRA Toxic Release Inventory Program for the release of pollutants at MSFC. In 2005, a report was submitted for di-isocyanate compounds (NASA 2007a).

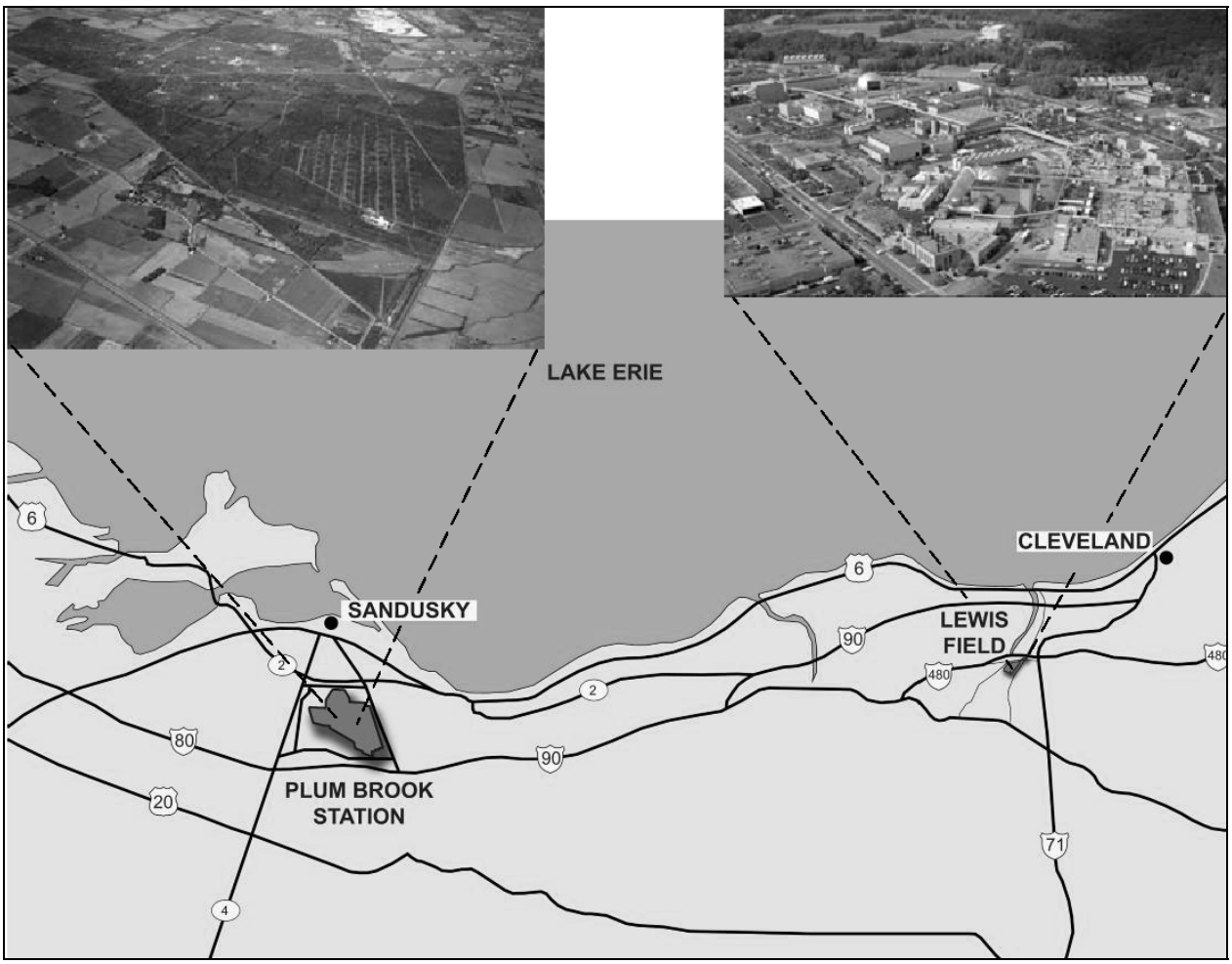
Nonhazardous waste is primarily collected and hauled by a contractor to a local incinerator. Nonhazardous waste excluded from incineration is disposed of in the Redstone Arsenal construction debris landfill (MSFC 2002a). During 2005, 1.45 million kg (3.2 million lbs) of solid waste were generated at MSFC (MSFC 2006a).

3.1.6 John H. Glenn Research Center

NASA's GRC specializes in power, propulsion, communications, and micro-gravity science research. GRC consists of two sites in Ohio, Lewis Field in western Cuyahoga County (near Cleveland) and Plum Brook Station (PBS) in west-central Erie County, approximately 80 km (50 mi) west of Lewis Field (see Figure 3-12). For the Constellation Program, Lewis Field would manage Orion Service Module and Spacecraft Adapter development and provide Ares Upper Stage support and development. PBS would provide Orion acoustic/random vibration, thermal vacuum, and electromagnetic compatibility/interference testing, Ares Upper Stage engine testing, and integrated stages testing.

3.1.6.1 Land Resources

The GRC Lewis Field site is predominantly within the limits of the city of Brook Park, approximately 32 km (20 mi) southwest of downtown Cleveland. Lewis Field is bordered by the Cleveland Hopkins International Airport to the east and to the north and west is the Rocky River Reservation, a part of the Cleveland Metropolitan Park District. The southern boundary of Lewis Field is adjacent to highly urbanized and developed residential areas, business districts, and industrial complexes (GRC 2005).



Source: GRC 2006b

Figure 3-12. GRC Location and Vicinity Map

Lewis Field encompasses approximately 142 ha (350 ac) of land and contains more than 140 buildings, structures, and other facilities that support NASA's wide array of research, technology, and development programs (see Figure 3-13). Most of Lewis Field is considered fully developed with offices, test facilities, and support facilities, with the exception of approximately 69 ha (171 ac) that are considered undeveloped (GRC 2005).

PBS is operated as a satellite facility (component installation) of GRC and performs various research related to aerospace applications. Use of the site by the Federal Government began in the early 1940s when the U.S. Army established the Plum Brook Ordnance Works for the manufacture of munitions. Munitions production took place throughout the early 1940s, after which buildings and production lines were decontaminated and decommissioned. Ownership of the property subsequently transferred to NASA and the property was renamed PBS (GRC 2005).

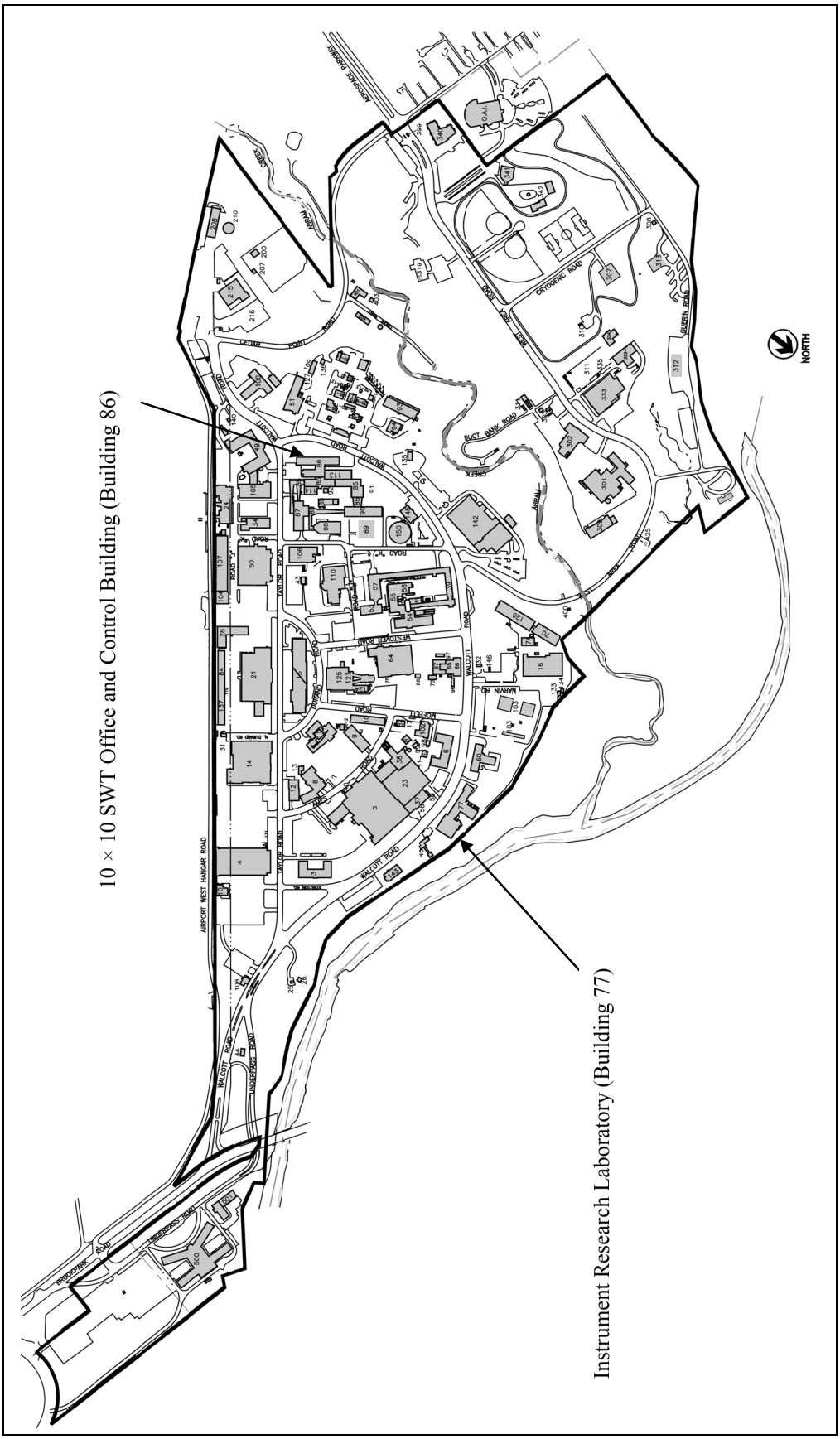
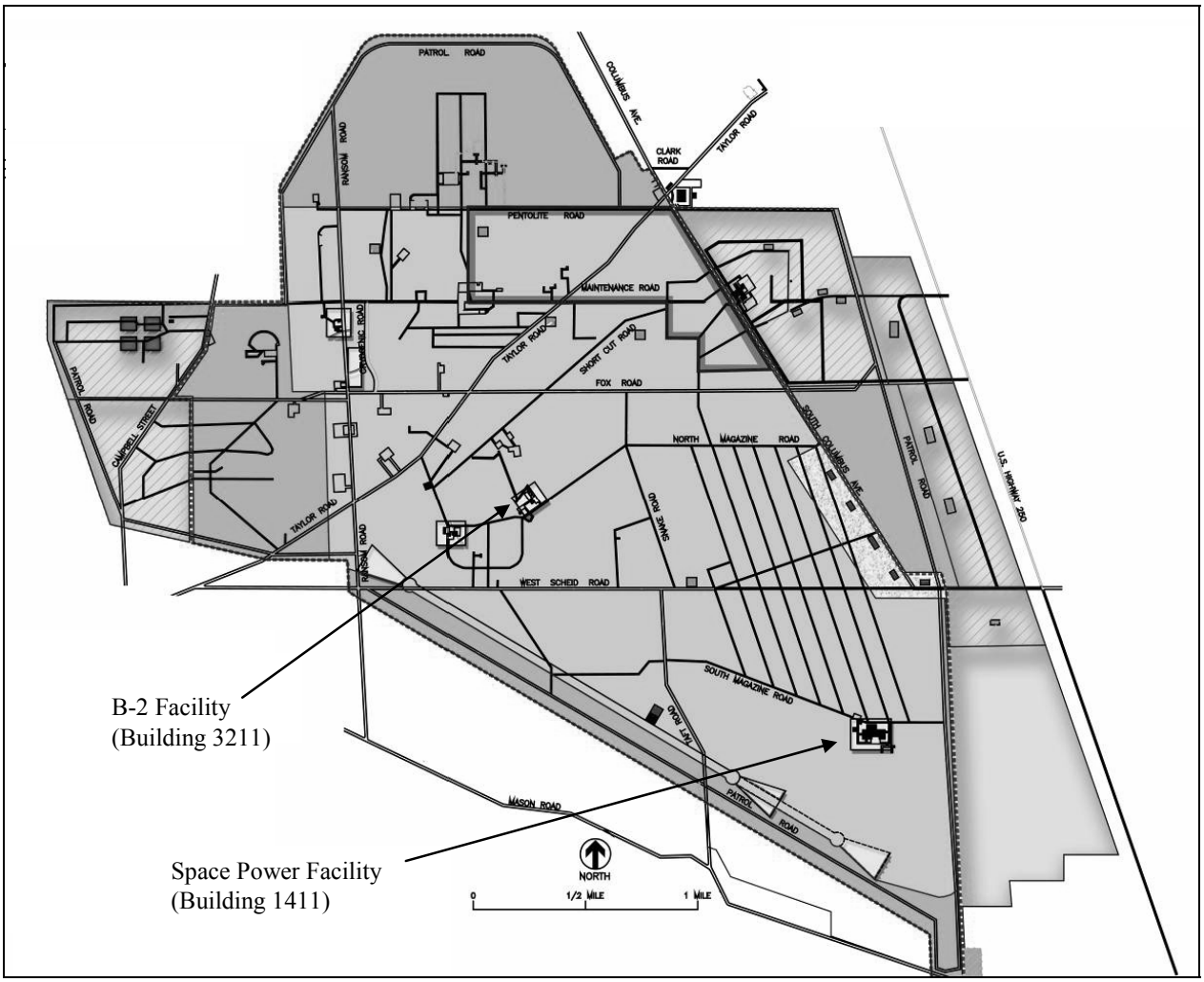


Figure 3-13. GRC Lewis Field Facilities Map

PBS encompasses 2,614 ha (6,454 ac) of rural land, located approximately 6 km (4 mi) south of Sandusky, Ohio. Most of PBS consists of forestland and old fields and the surrounding area is largely rural and agricultural. PBS houses more than 174 buildings and structures, including offices, mechanical and process equipment areas, test facilities, substations, warehouses, and wastewater treatment facilities. The vast majority of these facilities are currently inactive. Of the few active facilities at PBS are the Space Power Facility (Building 1411) and the Spacecraft Propulsion Research Facility (B-2 Facility) (Building 3211) (see Figure 3-14). The Space Power Facility was designed to allow for the testing of space power generation systems under simulated space environmental conditions. The facility can fully simulate space vacuum, temperature, and solar environments for various test configurations. The B-2 Facility is used for research, development, and validation testing of spacecraft and space propulsion systems. The facility can simulate vacuum, cryogenic background temperatures, and solar heating conditions found in near-Earth orbit (GRC 2005).



Source: GRC 2005

Figure 3-14. GRC Plum Brook Facilities Map

NASA is currently in the process of preparing a facility-wide land use master plan to address future development at GRC Lewis Field and PBS, for which NASA is currently preparing an Environmental Assessment, anticipated to be completed later this year.

3.1.6.2 Air Resources

3.1.6.2.1 Climate

The climate in this region of Ohio can be classified as continental. Summers are warm and humid, with average temperatures of 70ºF (21ºC). Winters are relatively cold and cloudy, with an average temperature of 28ºF (-2ºC). Precipitation averages approximately 89 cm (35 in) per year. Prevailing winds are typically from the south to southwest (GRC 2005).

3.1.6.2.2 Air Quality

Air quality at Lewis Field and PBS is regulated through the NAAQS promulgated under the CAA. See Section 3.1.1.2 for a discussion of primary and secondary air quality standards and criteria pollutants.

Lewis Field is classified as a major source of air emissions and operates under a CAA Title V permit. The majority of emissions from Lewis Field result from the combustion of fuels, including natural gas, #2 fuel oils, and jet fuels. Other sources include air heaters, boilers, and steam generators. Cuyahoga County is designated as a nonattainment area for the $PM_{2.5}$ and 8-hour ozone standards. Cuyahoga County also is designated as a maintenance area for PM_{10}, CO, and SO_2 (EPA 2007c).

PBS is classified as a minor source of air emissions under Title III and Title V of the CAA and is registered under the Ohio EPA Non-Title V Emission Fee (Blue Card) Program in conjunction with a Presumed Inherent Physical Limitation (the inability to discharge air pollutants in quantities that trigger Title V requirements). Sources of air pollutants at PBS, other than mobile sources such as automobiles and construction equipment, include boilers, heaters, research test cells, a degreaser, and other minor sources (GRC 2005). Erie County is designated as an attainment area for all NAAQS (EPA 2007c).

3.1.6.3 Water Resources

3.1.6.3.1 Potable Water

Lewis Field and PBS receive potable water from the city of Cleveland municipal water supply system and the Erie County Water Division, respectively. Both municipalities use surface water as the source (GRC 2005).

3.1.6.3.2 Surface Water

The primary surface water features at Lewis Field are the Rocky River and its tributary, Abram Creek. The Rocky River flows along the western edge of Lewis Field, separating it from the Rocky River Reservation of the Cleveland Metropolitan Park District. After passing Lewis Field, the river flows north and discharges into Lake Erie. Abram Creek begins in a low-lying

area south of Cleveland Hopkins International Airport and flows through a heavily urbanized area, crossing the Lewis Field property. It travels approximately 6 km (4 mi) to its confluence with the Rocky River (GRC 2005).

Wastewater at Lewis Field is composed of sanitary, stormwater, noncontact and contact cooling, cooling tower blowdown, and miscellaneous process discharges. There are three wastewater collection systems at Lewis Field, including sanitary, stormwater, and industrial. The sanitary sewer system discharges by permit to the Southerly Wastewater Treatment Plant of the Northeast Ohio Regional Sewer District. Stormwater discharges are regulated under two separate Ohio EPA NPDES permits. Stormwater monitoring has indicated occasional exceedances of chlorine. These findings have been reported to the Ohio EPA with no additional action occurring from the Ohio EPA. After onsite settling and oil separation, industrial wastewater is discharged by permit to the sanitary sewer system (GRC 2005).

The Rocky River and Abram Creek are classified as Warmwater Habitats by the Ohio EPA and portions of the Rocky River are designated as "Seasonal Salmonid" due to the occasional migration of salmon. Other use designations for portions of Abram Creek and the Rocky River include Primary Contact Recreation (swimming) and Agricultural and Industrial Water Supply. In addition, because the Rocky River flows through the Cleveland Metroparks, it is designated as a State Resource Water in the vicinity of Lewis Field. This designation affords special protection under the state's anti-degradation policy (GRC 2005).

The Ohio EPA has reported that sections of the Rocky River and Abram Creek in the vicinity of Lewis Field display signs of environmental degradation and do not meet the warmwater habitat aquatic life use designation. Stream flow patterns indicative of highly urbanized storm flow drainage may be important factors in explaining the degradation of stream biota (GRC 2005).

Floodplains at Lewis Field occur at Abram Creek. Abram Creek fulfills the criteria for an area of special flood hazard (defined as an area of land that would be inundated by a flood having a one percent chance of occurring in any given year). No other mapped floodplains occur at Lewis Field and no facilities are within the 100-year floodplain. The 500-year floodplain for Lewis Field has not been mapped. Wetlands at Lewis Field have not been officially delineated; however, a study performed in 2002 identified four areas as probable wetlands. No activities currently occur in these four areas (GRC 2005).

PBS is located in an area that supports multiple surface water systems that are within the Lake Erie watershed. Eleven streams cross PBS, the largest of which are Pipe Creek, Kuebler Ditch, Ransom Brook, and Plum Brook. Streams generally flow northward and converge into Ransom Creek, Storrs Ditch, Plum Brook, and Sawmill Creek and eventually flow into Lake Erie. More than 17 isolated ponds and reservoirs also are located on PBS (GRC 2005).

All surface waters at PBS are classified as Warmwater Habitats by the Ohio EPA. Other use designations applicable to PBS streams include Primary Contact Recreation and Agricultural and Industrial Water Supply. Although water quality in the streams that originate or flow through PBS is believed to be generally good, there are two surface water areas at PBS that have been affected by trinitrotoluene (TNT) manufacturing operations in the early 1940s. One of the areas, designated as the Pentolite Road Pond, is in the process of remediation by the U.S. Army Corps

of Engineers as part of the clean-up of the former Plum Brook Ordnance Works. Further remediation of the second area, designated as the West Area Red Water Ponds, has not been recommended at this time (GRC 2005).

PBS operates under an NPDES permit (number OH 2IO00002) that specifies wastewater discharge limitations and monitoring requirements for multiple outfall points on PBS. Wastewater discharges at PBS include stormwater, noncontact cooling water, cooling tower and boiler blowdown, and sanitary discharges. Domestic sewage is primarily routed to the Erie County Sewage Treatment Works (GRC 2005).

Portions of PBS lie within the 100- and 500-year floodplains. However, no PBS facilities remain in the 100-year floodplain. In addition, there are no activities at PBS that are located in either floodplain. Wetlands at PBS have not been officially delineated. However, based in studies performed to date, there are no known activities currently located in wetlands (GRC 2005).

3.1.6.3.3 Groundwater

Groundwater at Lewis Field occurs in two distinct lithologic zones, in the shale bedrock and in perched lenses in the overlying unconsolidated materials. These zones are approximately 15 to 76 cm (6 to 30 in) thick. The zones are thought to be isolated and not to contain significant amounts of groundwater. Groundwater in the unconsolidated zone is expected to discharge to Abram Creek and the Rocky River. The groundwater zone within the bedrock is under artesian pressure due to the low hydraulic conductivity of the overlying soils. The recharge rate is estimated to be very slow and the shale bedrock has very low permeability (GRC 2005).

There are several permitted drinking water wells within 6 km (4 mi) of Lewis Field and many individuals in the Rocky River Basin use groundwater for drinking. However, groundwater is not used for drinking water at Lewis Field and no aquifer has been designated as a sole or principal drinking water source supply at Lewis Field. In addition, there is no evidence of groundwater contamination or any underground injection wells at Lewis Field (GRC 2005).

PBS is underlain by an overburden aquifer and a limestone and dolomite bedrock aquifer. The bedrock aquifer is overlain by unconsolidated deposits of glacial origin. These unconsolidated deposits comprise the overburden aquifer. The thickness of the overburden aquifer ranges from less than 1.5 m (5 ft) to greater than 8 m (25 ft). Groundwater flow is to the north-northwest toward Lake Erie. The limestone and dolomite aquifer is the primary source of groundwater for Erie County. Although most of the wells surrounding PBS are used for agricultural purposes, a few wells in the vicinity of PBS are used for private and public consumption. No groundwater at PBS is used for private or public consumption.

Groundwater at PBS has been contaminated as a result of munitions manufacturing at the former Plum Brook Ordnance Works. Groundwater investigations are being conducted by the U.S. Army Corps of Engineers in connection with site remediation activities. Ongoing groundwater investigations have identified several contaminants, including nitroaromatics, VOCs, semivolatile organic compounds, and metals (GRC 2005).

3.1.6.4 Ambient Noise

The Cleveland Hopkins International Airport is the largest noise source in the general vicinity of Lewis Field. Other noise sources include a nearby automotive factory, traffic noise from two major interstate highways, and a large exhibition hall. Noise sources at Lewis Field include research operations (*e.g.*, wind tunnels and engine test cells), NASA aircraft, construction activities, and traffic noise. The general noise level at Lewis Field is well below the average day/night sound level of the Cleveland Hopkins International Airport. Noise levels at the Lewis Field fence line are generally below 70 dBA and are primarily attributed to offsite sources (GRC 2005).

Sources of noise at PBS include an unpaved airstrip, which accommodates light aircraft; transient noise blasts from test facilities; construction activities; and traffic noise. The Army Reserves and the Ohio Air National Guard occasionally discharge pyrotechnic devices at PBS. The nearest public receptor facilities are generally more than 305 m (1,000 ft) from the PBS boundary. None of the noise generating activities at PBS are believed to be a significant source of noise impacts and no noise complaints have been recorded at PBS (GRC 2005).

3.1.6.5 Geology and Soils

3.1.6.5.1 Geology

The area near Lewis Field consists of gently rolling uplands created by glacial outwash. Lewis Field is generally level due to extensive cut-and-fill operations that reclaimed the area from steep drainage swales. These drainage features were filled in with a variety of undifferentiated soils and gravels, construction debris, and industrial and domestic waste (GRC 2005).

The area surrounding Lewis Field is located on the western flank of the undeformed portion of the Appalachian Basin. The basin contains a southeastward-thickening prism of sandstones, carbonates, shales, and salts that aggregate to a thickness of approximately 1,980 to 7,010 m (6,500 to 23,000 ft). Bedrock in the immediate vicinity of Lewis Field is composed of the Cleveland Shale Member of the Ohio Shale. The probability of an earthquake causing structural damage is minimal. The Ohio Shale is fissile, however, and offers differential resistance to applied stresses depending upon the inclination to the direction of stratification (GRC 2005).

PBS is located on land that was once lake bottom formed from glacial melt waters. The area is relatively flat and slopes gently northward. Elevations range from approximately 191 to 207 m (625 to 680 ft) above sea level. Bedrock in the area consists of carbonates and clastics (sandstones and shales). The depth of the bedrock is highly variable and can range from 0.7 to 7.6 m (2 to 25 ft). The probability of an earthquake causing structural damage at PBS is minimal (GRC 2005).

3.1.6.5.2 Soils

Soils in the vicinity of Lewis Field generally have low to very low permeability and are classified as a silty clay loam, although they often grade to a clay loam glacial till. The natural

soils and parent materials in many cases have been removed or covered with fill. There are no prime farmlands within Lewis Field (GRC 2005).

Results from a recent soil sampling effort at Lewis Field indicate the presence of asbestos and organic and metallic chemicals (GRC 2006a). In addition, several areas that were contaminated with PCBs have been remediated (GRC 2005).

The area surrounding PBS is known for its agricultural productivity and farmland. Although much of the native soil was disturbed during construction of Plum Brook Ordnance Works and later by NASA, there are still vast tracts of undisturbed native soils at PBS. The soils at PBS are typically light-textured, often sandy with moderate to slightly acidic pH, and are highly variable in thickness and permeability. As a result of past Army activities at PBS during Plum Brook Ordnance Works operations, the U.S. Army Corps of Engineers is conducting remediation activities in several areas of soil contamination (*e.g.*, PCBs, TNT, diesel oil, lead, and #2 fuel oils) (GRC 2005).

3.1.6.6 Biological Resources

Lewis Field lies in the Beech-Maple Forest region of the great eastern Deciduous Forest of North America. This region has been classified as a mixture of Beech Forest, Mixed Oak Forest, Elm-Ash Swamp Forest, and Mixed Mesophytic Forest. Most of the site is now too highly disturbed to support significant numbers of indigenous Ohio plant species. The gorge of Abram Creek and the tops of the bluffs above the valley are the only areas that retain natural qualities (GRC 2005).

Animals that inhabit Lewis Field include birds, amphibians, reptiles, butterflies and moths, and various mammals. Most common birds include the European starling, house sparrow, American robin, chimney swift, and house finch. Three amphibian species, one reptile species, many species of butterflies and moths, and three common bat species have been identified at Lewis Field. Other mammals, such as squirrels, chipmunks, rabbits, deer, and groundhogs, also likely inhabit the area (GRC 2005).

PBS contains vast natural resources in the form of a complex mosaic of plant communities in various successional stages and hydrologic regimes. Much of PBS is undeveloped natural areas or recovering natural areas previously used for agriculture. The size and diversity of natural habitats at PBS support a large number of plant and animal species.

Two state-listed potentially threatened plant species, pigeon grape (*Vitis cinerea*) and American chestnut (*Castanea dentata*), are found at Lewis Field. There is no evidence of any federally threatened or endangered animal species at Lewis Field (GRC 2005).

PBS supports large numbers of protected plant and animals species, including one federally protected species (the bald eagle [*Haliaeetus leucocephalus*]), seven state-listed endangered, nine threatened, 11 potentially threatened, and seven species of special concern (GRC 2005).

3.1.6.7 Socioeconomics

This section addresses the existing socioeconomic conditions and characteristics in the GRC Lewis Field and PBS regional areas. The Lewis Field regional area is defined here as the land

area within an 80.5-km (50-mi) radius of Lewis Field, which includes Lorain, Medina, Summit, Cuyahoga, Geauga, and portions of Lake, Erie, Portage, Huron, Ashland, Wayne, Stark, Trumbull, Ashtabula, Richland, and Ottawa Counties. The PBS regional area is defined here as the land area within an 80.5-km (50-mi) radius of PBS, which includes Ottawa, Sandusky, Seneca, Erie, Huron, Lorain, and portions of Medina, Ashland, Richland, Crawford, Lucas, Wood, Hancock, Wyandot, Morrow, Wayne, and Cuyahoga Counties (USBC 2006a).

3.1.6.7.1 Population

The total population within the Lewis Field regional area was approximately 3,410,700 persons in 2000 (see Table 3-7) (USBC 2006a). The total population is expected to increase to approximately 3,480,500 by 2010 and to approximately 3,544,240 by 2020. Similar increases are anticipated in Cuyahoga County, where the total population was approximately 1,393,980 persons in 2000 and is expected to increase to approximately 1,422,505 by 2010 and to approximately 1,448,550 by 2020 (USBC 2000).

Table 3-7. Population of the Lewis Field Regional Area and Cuyahoga County for 2000, 2010, and 2020

Population	Lewis Field Regional Area			Cuyahoga County		
	2000	2010*	2020*	2000	2010*	2020*
White	2,757,548	2,759,790	2,753,199	938,863	939,626	937,382
Black or African American	518,370	569,993	623,795	382,634	420,739	460,453
American Indian and Alaska Native	6,513	7,395	8,268	2,529	2,872	3,211
Asian	42,351	56,211	68,982	25,245	33,507	41,120
Native Hawaiian and Other Pacific Islander	692	918	1,127	338	449	551
Some other race	35,093	39,885	44,910	20,962	23,842	26,826
Two or more races	50,136	—	—	23,407	—	—
Hispanic or Latino (of any race)	84,920	106,772	132,868	47,078	59,193	73,660
Total Population	**3,410,703**	**3,480,500**	**3,544,236**	**1,393,978**	**1,422,505**	**1,448,554**
Percent Minority	**19.15**	**20.71**	**22.32**	**32.65**	**33.95**	**35.29**

Sources: USBC 2000, USBC 2006a

* Projected population values for 2010 and 2020 do not represent absolute limits to growth; for any group, the future population may be above or below the projected value.

Note: Because an individual may report more than one race, the aggregate of the population groups may not match the total population.

In 2000, minority race populations represented approximately 19 percent of the total population within the Lewis Field regional area and approximately 33 percent of the total population within Cuyahoga County. The Black or African American population was the largest minority group living within the Lewis Field regional area and Cuyahoga County in the year 2000. Between 2000 and 2020, minority race populations are expected to increase to 22 percent of the total population within the Lewis Field regional area and approximately 35 percent of the total population within Cuyahoga County. The Black or African American population is estimated to

remain the largest resident minority group within the Lewis Field regional area and Cuyahoga County in 2020 (USBC 2000, USBC 2006a).

The total population within the PBS regional area was approximately 1,716,480 persons in 2000 (see Table 3-8) (USBC 2006a). The total population is expected to increase to approximately 1,751,600 by 2010 and to approximately 1,783,680 by 2020. Similar increases are anticipated in Erie County, where the total population was approximately 79,550 persons in 2000 and is expected to increase to approximately 81,180 by 2010 and to approximately 82,670 by 2020 (USBC 2000).

Table 3-8. Population of the PBS Regional Area and Erie County for 2000, 2010, and 2020

Population	PBS Regional Area			Erie County		
	2000	2010*	2020*	2000	2010*	2020*
White	1,537,283	1,538,533	1,534,859	70,514	70,571	70,403
Black or African American	94,718	104,151	113,982	6,876	7,571	8,274
American Indian and Alaska Native	3,970	4,508	5,040	164	186	208
Asian	16,951	22,498	27,610	298	396	485
Native Hawaiian and Other Pacific Islander	413	548	673	4	5	7
Some other race	33,727	38,332	43,161	420	477	537
Two or more races	29,416	—	—	1,275	—	—
Hispanic or Latino (of any race)	78,873	99,169	123,407	1,664	2,092	2,604
Total Population	**1,716,478**	**1,751,604**	**1,783,680**	**79,551**	**81,179**	**82,666**
Percent Minority	**10.44**	**12.16**	**13.95**	**11.36**	**13.07**	**14.83**

Sources: USBC 2000, USBC 2006a

* Projected population values for 2010 and 2020 do not represent absolute limits to growth; for any group, the future population may be above or below the projected value.

Note: Because an individual may report more than one race, the aggregate of the population groups may not match the total population.

In 2000, minority race populations represented approximately 10 percent of the total population within the PBS regional area and approximately 11 percent of the total population within Erie County. The Black or African American population was the largest minority group living within the PBS regional area and Erie County in the year 2000. Between 2000 and 2020, minority race populations are expected to increase to 14 percent of the total population within the PBS regional area and approximately 15 percent of the total population within Erie County. The Black or African American population is estimated to remain the largest resident minority group within the PBS regional area and Erie County in 2020 (USBC 2000, USBC 2006a).

3.1.6.7.2 Economy

Industrial sectors in the Lewis Field and PBS regional areas that provide significant employment include education, health, and social services; manufacturing; retail trade; and professional, scientific, management, administrative, and waste management services. An estimated

2,643,833 people were employed in the Lewis Field regional area in 2000 with an estimated unemployment rate of 5.0 percent. An estimated 1,326,232 people were employed in the PBS regional area in 2000 with an estimated unemployment rate of 4.6 percent. The national and Ohio unemployment rates during the same period were estimated at 5.8 and 5.0 percent, respectively. The estimated percent of persons living below the poverty level (low-income persons) in 2000 was as follows: U.S. – 12.4 percent, Ohio – 10.6 percent, Lewis Field regional area – 9.9 percent, PBS regional area – 9.1 percent, Cuyahoga County – 12.9 percent, and Erie County – 8.1 percent (USBC 2006a).

GRC at Lewis Field and PBS contribute significantly to the local, state, and national economies. In fiscal year 2003, GRC, as a whole, generated $1,288 million in spending throughout Ohio. Of this, $439 million resulted from direct spending and more than $849 million resulted from indirect and induced spending throughout the regional economy (GRC 2003). GRC employs approximately 3,110 civil servants and support contractors, of which 14 civil servants and 86 contractors support PBS. The vast majority of GRC's workforce lives in Cuyahoga County (GRC 2005).

3.1.6.7.3 Transportation

Lewis Field has fully developed infrastructure, including road access and all utilities to support its occupational needs. The transportation network in the vicinity of Lewis Field consists of two major highways, Interstate 480 and Interstate 71. These are heavily traveled roads that are often congested during morning and afternoon rush hours. There are many secondary roads also serving the area. Most commuting to Lewis Field is by automobile. The Greater Cleveland Regional Transit Authority provides limited public transportation to Lewis Field. Lewis Field is adjacent to the Cleveland Hopkins International Airport, which provides national and international air service (GRC 2005).

PBS also has fully developed infrastructure, including road access and all utilities to support its occupational needs. PBS has a 101-km (62.5-mi) internal paved road system. There is also a railroad within PBS that is currently unused. Several state roads service the area, including Route 2, north of PBS, which is a major thoroughfare between Cleveland and Toledo, and Interstate 80 and 90 located just to the south. Traffic is moderate in the winter, but increases dramatically during the summer tourist months because of local area tourist attractions (GRC 2005).

3.1.6.7.4 Public and Emergency Services

Emergency services for Lewis Field are provided by the Cleveland Port Authority and the adjacent communities of Brook Park and Fairview Park. Lewis Field also has an onsite medical facility where employees can be treated for acute injuries and illness or occupational injuries during normal working hours (GRC 2005).

Health, emergency, and fire services at PBS are provided by Perkins Township under an informal cooperative agreement. The nearest hospital is approximately 8 km (5 mi) away in Sandusky. Staff at the PBS Plant Protection Office are trained in emergency response procedures.

3.1.6.8 Cultural Resources

Facilities at Lewis Field that would be associated with the Constellation Program and are eligible for individual listing in the NRHP include the Instrument Research Laboratory (Building 77), and 10- by 10-ft Supersonic Wind Tunnel Office and Control Building (Building 86) (GRC 2006b, GRC 2006c). The Central Area at Lewis Field also is eligible for listing in the NRHP as a Historic District (GRC 2005).

The Spacecraft Propulsion Research Facility (B-2 Facility) (Building 3211) at PBS is a designated National Historic Landmark (DOI 2007a, DOI 2007b). The Space Power Facility (Building 1411) is facility that would be associated with the Constellation Program and is eligible for individual listing in the NRHP.

There are no known archeological resources associated with Constellation Program activities at Lewis Field or PBS.

3.1.6.9 Hazardous Materials and Waste

Lewis Field is classified as a large-quantity generator of hazardous waste and is managed under RCRA Subtitle C. Lewis Field generates solid and hazardous waste from its research and development operations, facilities maintenance, construction, aerospace testing, cleaning, maintenance, equipment cleaning and degreasing, and photographic processes. In 2002, Lewis Field generated 83,515 kg (184,170 lb) and 275 cubic meters (m^3) (9,712 cubic feet [ft^3]) of hazardous wastes. Such wastes are disposed of offsite at certified hazardous disposal facilities by a licensed contractor. Furthermore, all hazardous materials and waste are managed in accordance with applicable Federal, state, and local rules and regulations (GRC 2005).

PBS is also classified as a large-quantity generator of hazardous waste due to high-volume wastes from past underground storage tank removals. Typical hazardous wastes from PBS consist of used solvents (chlorinated and nonchlorinated), oils, laboratory chemicals, fuels, lab packs, and waste from maintenance operations. Such wastes are disposed of offsite at certified hazardous disposal facilities by a licensed contractor. Furthermore, all hazardous materials and waste are managed in accordance with applicable Federal, state, and local rules and regulations (GRC 2005).

Nonhazardous waste at Lewis Field and PBS is collected and hauled by a licensed contractor to offsite landfill/recycling facilities (GRC 2005).

3.1.7 Langley Research Center

NASA's LaRC provides leading research in airframe systems and atmospheric sciences. For the Constellation Program, LaRC would manage the Orion Launch Abort System development, the Orion landing system development and testing, and the Ares ascent development flight test vehicle integration.

3.1.7.1 Land Resources

LaRC is located on a coastal plain in the northeastern portion of the city of Hampton, Virginia, approximately 240 km (150 mi) south of Washington, DC and 80 km (50 mi) southeast of

Richmond, Virginia, and occupies 327 ha (808 ac) (LaRC 2005) (see Figure 3-15). LaRC is divided into two areas, the West Area (see Figure 3-16) and the East Area (see Figure 3-17), separated by the runway facilities of Langley Air Force Base (LAFB). The majority of NASA's facilities are located on the West Area, comprising approximately 319 ha (788 ac). The West Area is bounded by Brick Kiln Creek to the north, State Route 172 to the west, and LAFB to the south and east. The East Area is an additional 8-ha (20-ac) area situated on LAFB property. To the south and north of LaRC are the developed residential communities of Hampton and Poquoson, respectively (LaRC 2005).

Land use at LaRC consists primarily of administration and management office space, engineering and research laboratories, services and support facilities, industrial/fabrication and test areas, recreational and open areas, and roadway and parking areas. The Center houses more than 220 buildings, which are capable of supporting a wide array of activities, including simulating the space environment, developing and testing new materials and hardware, and performing aircraft aerodynamics and stability testing. LAFB dominates land use in the immediate vicinity of LaRC.

LaRC is located within the "coastal zone" as defined under the Virginia Department of Environmental Quality Virginia Coastal Zone Management Program. Under the Virginia Coastal Resources Management Program a network of state agencies and local governments administer enforceable laws, regulations, and policies in the following areas: tidal and nontidal wetlands, fisheries, subaqueous lands, dunes and beaches, point source air pollution, point source water pollution, nonpoint source water pollution, shoreline sanitation, and coastal lands. All Federal actions and programs that directly affect Virginia's coastal zone must be carried out in a manner that is consistent with the enforceable policies comprising Virginia's Coastal Resources Management Program. Virginia Department of Environmental Quality Office of Environmental Impact Review may review Federal projects for consistency with enforceable policies during the NEPA process. Not all of these enforceable programs are applicable to the Proposed Action.

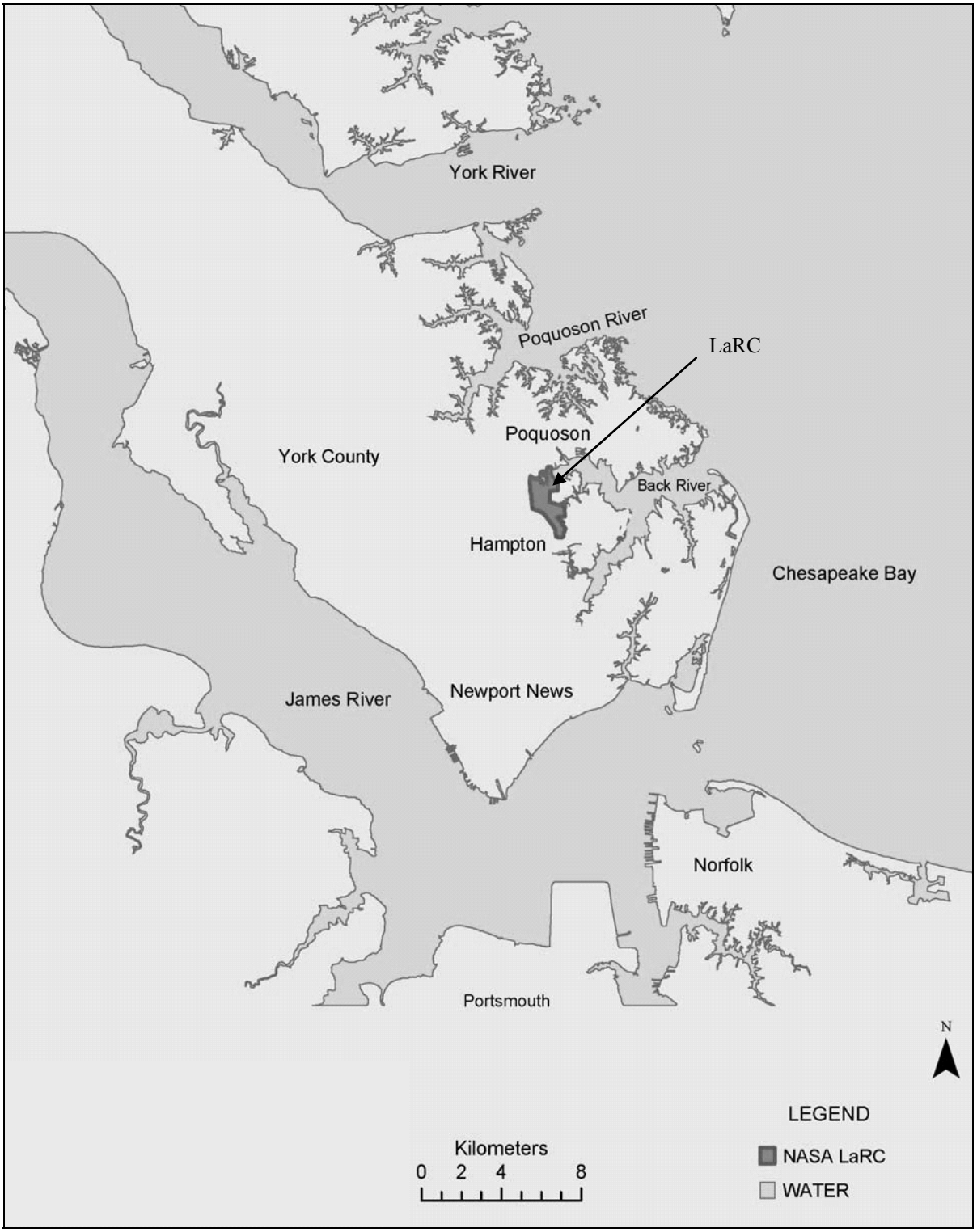
3.1.7.2 Air Resources

3.1.7.2.1 Climate

The climate at LaRC can be classified as modified continental with generally mild winters and warm, humid summers. Annual temperatures range from 32 to 85°F (0 to 29°C) and average monthly precipitation ranges from less than 0.64 cm (0.25 in) to more than 36 cm (15 in). Winds are predominantly from the south to southwest (LaRC 2005).

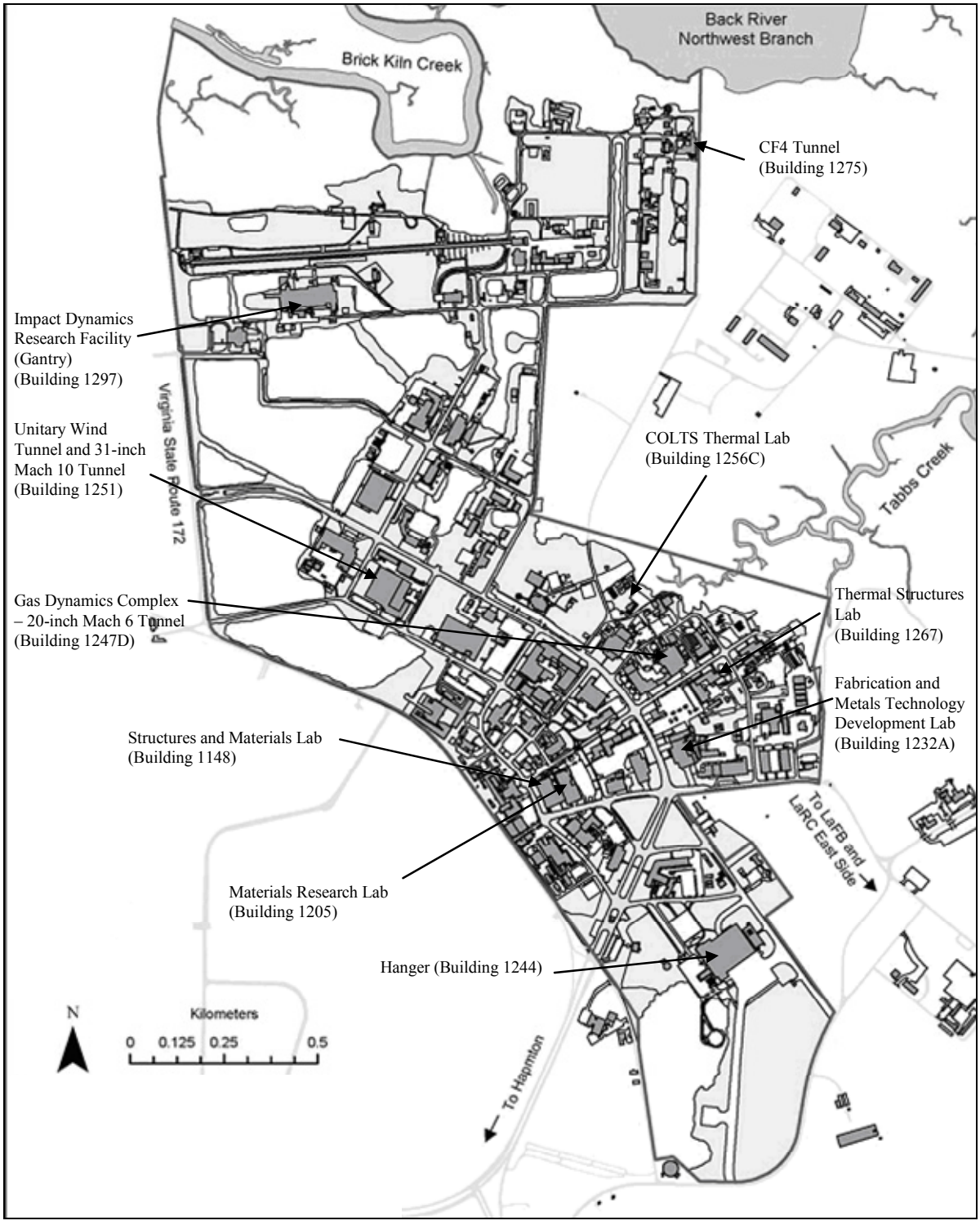
3.1.7.2.2 Air Quality

Air quality at LaRC is regulated through the NAAQS promulgated under the CAA. See Section 3.1.1.2 for a discussion of primary and secondary air quality standards and criteria pollutants. The NAAQS for criteria pollutants have been adopted by the Commonwealth of Virginia (VDEQ 2004). LaRC is located within the Hampton Roads Intrastate Air Quality Control Region.



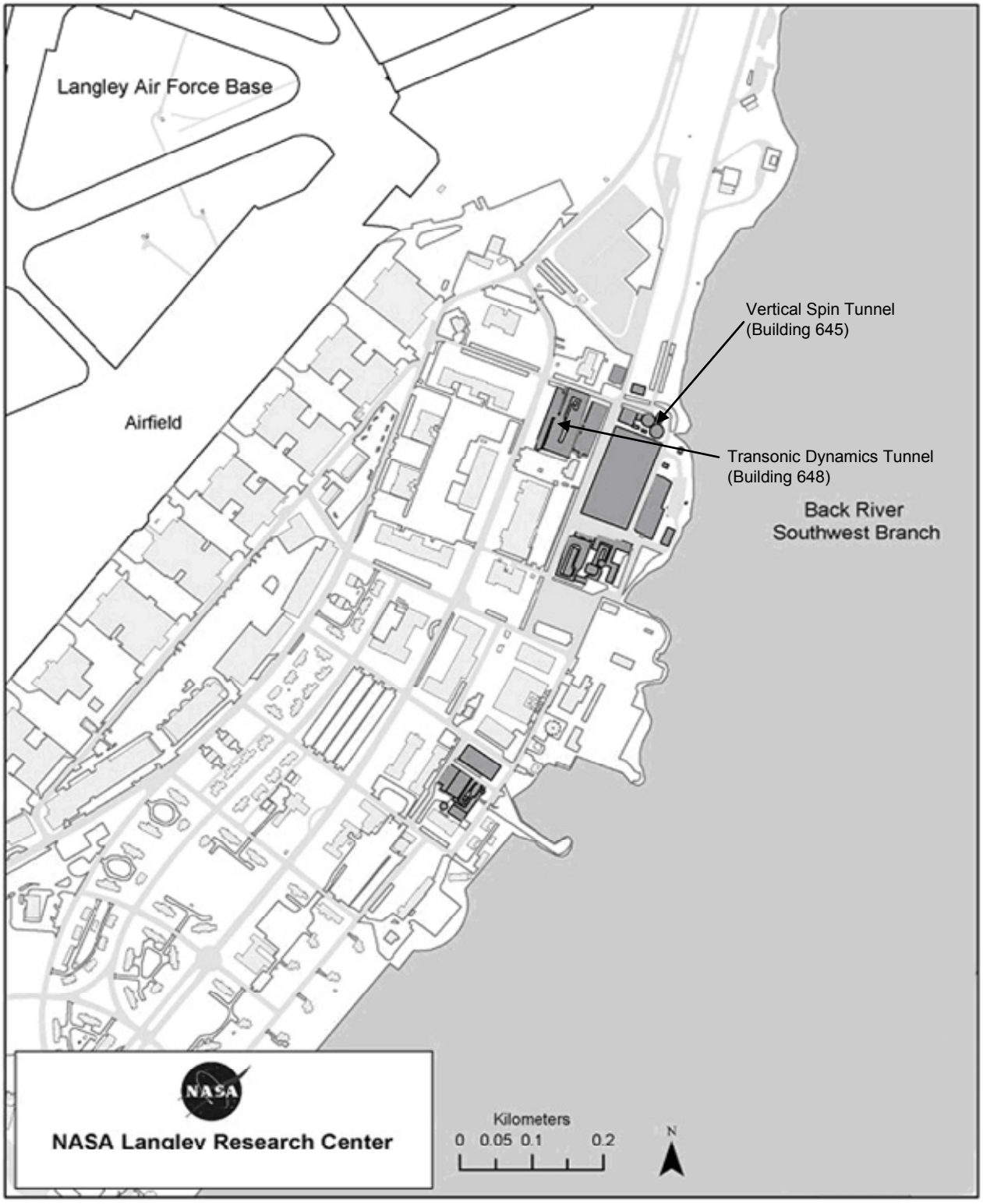
Source: LaRC 2005

Figure 3-15. LaRC Location and Vicinity Map



Source: LaRC 2005

Figure 3-16. LaRC West Area Map



Source: LaRC 2005

Figure 3-17. LaRC East Area Map

LaRC is not required to operate under a CAA Title V permit. LaRC qualifies as a synthetic minor source because its air emissions are limited below the prescribed thresholds by its state operating permit (ASF number 5165000006) (EPA 2007d). Air emission sources at LaRC include steam plant, various heating systems, burners, two underground gasoline storage tanks, spray booths, dust collectors, parts washers/degreasers, and miscellaneous testing facilities (*e.g.*, the 8-Foot High Temperature Tunnel and the Direct Connect Supersonic Test Facility) (LaRC 2005). Facility-wide emissions are significantly below the state permit threshold for criteria air pollutants, VOCs, and HAPs (LaRC 2005).

In the recent past, the Hampton Roads area had been designated as a marginal nonattainment area for the 8-hour ozone NAAQS (EPA 2007c). Based on an analysis of air quality monitoring data, source emission reduction information, and the existing Federal and state regulatory programs, on June 1, 2007, the EPA approved the redesignation request and the maintenance plan for the Hampton Roads area of Virginia (EPA 2007c).

3.1.7.3 Water Resources

3.1.7.3.1 Potable Water

LaRC receives its potable water supply from the Newport News Water Works. LaRC has water distribution facilities, but no water production or treatment facilities. In 2004, approximately 496 million l (131 million gal) of water was provided to LaRC's West Area. The primary use included cooling towers and steam production facilities (LaRC 2005).

3.1.7.3.2 Surface Water

LaRC is located on the small coastal basin of the Back River, a tidal estuary of the Chesapeake Bay. The Brick Kiln Creek runs along the northern boundary of LaRC, joining the northwest branch of the Back River, and drains approximately 40 percent of the West Area at the Center. Tabbs Creek, which drains most of the rest of the West Area and part of LAFB, flows in a northerly direction to join the Back River near the confluence of its northwest and southwest branches. A small southern portion of the West Area drains to Tides Mill Creek. The East Area drains to the Back River. The local waterways are influenced by tides in the Chesapeake Bay (LaRC 2005).

The waters in the local streams are designated by the state as Class IIa, estuarine waters where shellfish can be found. None of the waterways within LaRC qualify for the provisions of the Wild and Scenic Rivers Act (LaRC 2005).

LaRC operates under three water discharge permits, two from the State of Virginia and one from the Hampton Roads Sanitation District. The Hampton Roads Sanitation District permit (number 0085) allows LaRC to discharge nonhazardous industrial wastewater and sanitary sewage to the Hampton Roads Sanitation District sanitary sewer system. A Virginia Pollutant Discharge Elimination System permit (number 0024741), issued by the Virginia Department of Environmental Quality, authorizes LaRC to discharge to surface waters in accordance with the effluent limitations and monitoring requirements set forth in the permit. LaRC is allowed to discharge effluent from its operations to the surface waters of Virginia at nine outfall locations.

Three other locations contain only stormwater runoff rather than process water, and no monitoring is required. The other permit (number VAR040092), issued by the Virginia Department of Conservation and Recreation, is a general permit for Small Municipal Separate Storm Sewer Systems. This permit requires that LaRC develop, implement, and enforce a stormwater management program to reduce the discharge of pollutants from the Center to the maximum extent practicable (LaRC 2005).

The southwest branch of the Back River, near LAFB, is identified on the state's list of impaired waters due to high levels of fecal coliform. The watershed potentially receives inputs from residential sewage treatment systems, wetlands areas, and stormwater runoff associated with the surrounding residential and urban area. The specific source of the bacteria causing the fecal coliform bacteria standard violations is currently unknown. Overall, water pollution sources at LaRC are limited due to the relatively low level of industrial operations at LaRC. However, sampling studies conducted in the 1980s showed PCB and polychlorinated terphenyl (PCT) contamination in the sediments of Tabbs Creek and in the storm sewer lines connected to a LaRC outfall (LaRC 2005). LaRC subsequently was jointly listed with LAFB on the CERCLA National Priorities List in 1994. Clean-up of the PCB and PCT contamination was completed at LaRC by 2000 (EPA 2006c).

Nearly one-third of the West Area of LaRC is within the 100- and 500-year floodplains and approximately 8.1 ha (20 ac) of jurisdictional wetlands have been identified in the West Area of LaRC (LaRC 2005).

3.1.7.3.3 Groundwater

Groundwater near LaRC is present primarily in thick sequences of porous and permeable strata. These strata form regional aquifers, and less permeable strata form confining units between aquifers. The groundwater is recharged principally by infiltration of precipitation and percolation to the water table. Most of the unconfined groundwater flows relatively short distances and discharges to nearby streams, but a small amount flows downward to recharge the deeper, confined aquifers. Groundwater movement at LaRC is tidally influenced at locations near Brick Kiln Creek and Tabbs Creek (LaRC 2005).

Groundwater near LaRC is often brackish because of the Chesapeake Bay's close proximity and marine deposits found in the soil. Since 1995, samples collected from monitoring wells at LaRC have not shown contamination of the groundwater (LaRC 2005).

3.1.7.4 Ambient Noise

Primary noise sources at LaRC include the wind tunnels, compressor stations, and substations. Most of the wind tunnels are closed-loop tunnels and the noise generated is contained largely within the building. In addition, many of the laboratories and shops have equipment that produces high interior noise levels within the buildings (LaRC 2005).

Although the military aircraft operating from LAFB are by far the dominant and most widespread noise source in the area, several LaRC facilities located close to the property line produce noise levels higher than ambient levels outside the property line. At times, some of the

large, closed-circuit wind tunnels that have large electrical power requirements operate during extended, off-peak hours at night. The major noise sources at LaRC include the Jet Exit Test Facility (Building 1234), National Transonic Facility (Building 1236), 8-Foot High Temperature Tunnel (Building 1265A-E), Landing Loads Compressor and Control Building (Building 1258), 14 × 22-Foot Subsonic Tunnel (Building 1241), and the Transonic Dynamics Tunnel (Building 648). The 8-Foot High Temperature Tunnel is considered to be the loudest of these sources, reaching 112 dB at the end of East Reid Street (near the tunnel exhaust end) during a tunnel run. Runs typically last 2 or 3 minutes and occur once a day, several days a week. In addition, several wind tunnel operations at LaRC, such as the 8-Foot High Temperature Tunnel, produce noticeable vibrations outside the LaRC property. However, due largely to the lack of major residential development in the immediate vicinity of LaRC, there have not been significant complaints regarding noise or vibrations from LaRC operations (LaRC 2005).

The Transonic Dynamics Tunnel, which would be used to support the Constellation Program, has a maximum operating noise level of 47 dBA in the community adjacent to LaRC (LaRC 2005).

3.1.7.5 Geology and Soils

3.1.7.5.1 Geology

LaRC is located on the Virginia Coastal Plain, characterized by flat land cut by rivers, creeks, and streams. The Coastal Plain is underlain by layers of Cretaceous and younger clay, sand, and gravel that dip gently eastward. Fossilized marine layers are mixed with the Cretaceous clays and miscellaneous beach, estuarine, and fluvial deposits. The youngest deposits of the Coastal Plain are sand, silt, and mud (VDMR 2001). LaRC is located in an area designated as Seismic Risk Zone 1, which is an area with minor damage expected (LaRC 2005).

3.1.7.5.2 Soils

The soils at LaRC range in texture from clay and silt to fine gravel, with most of the soils being fine to medium sandy loam. These soils are considered to be poorly drained to moderately well-drained. The surface is a deposited loam from 0.6 to 1.8 m (2 to 6 ft) in depth (LaRC 2005).

Previous activities at LaRC have resulted in areas of soil contamination along Tabbs Creek (*e.g.*, PCBs and PCTs), which are managed under CERCLA (EPA 2006c) (see Section 3.1.7.3 for more details). In addition, an old construction debris landfill, located at the north edge of LaRC near Brick Kiln Creek, has been placed on the CERCLA National Priorities List.

3.1.7.6 Biological Resources

The predominant ecological feature of the LaRC region is the Chesapeake Bay. With its extensive open-water areas and associated tidal flats, creeks, and marshes, the Chesapeake Bay is a major migratory flyway and provides important waterfowl nesting and wintering habitat. Two designated preservation areas are located in the vicinity of LaRC, including the Plum Tree Island National Wildlife Refuge in the city of Poquoson and the North End Point Natural Preserve in

the city of Hampton. There are no designated conservation areas on LaRC property (LaRC 2005).

LaRC supports a wide-array of terrestrial and aquatic resources. These resources provide a broad range of natural habitat for hundreds of species of flora and fauna. The predominant types of plant communities within LaRC include mixed deciduous/pine forest, disturbed forest, pine plantation, open field, disturbed deciduous forest with brackish influence, brackish tidal marshes, brackish ponds with occasional tidal influence, palustrine freshwater ponds, and brackish and freshwater ditch systems. Aquatic fauna include fish, crustaceans, and mollusks, as well as some amphibian and reptile species. Terrestrial fauna include a large variety of mammals and birds, and several species of amphibians and reptiles (LaRC 2005).

No state or federally threatened or endangered plant, mammal, or fish species have been identified at LaRC. Three reptile and amphibian species listed as endangered or threatened have been observed in the area, but not identified at LaRC. The canebrake rattlesnake (*Crotalus horridus atricaudatus*) is listed by the state as an endangered species, the Eastern glass lizard (*Ophisaurus ventralis*) is state-listed as a threatened species, and the Kemp's Ridley sea turtle (*Lepidochelys kempii*) is on the Federal and state endangered lists. Four state and federally protected, endangered, or threatened bird species also have been identified, including the brown pelican (*Pelicanus occidentalis*), least tern (*Sterna antillarum*), bald eagle (*Haliaeetus leucocephalus*), and piping plover (*Charadrius melodus*). Five additional bird species are listed as endangered or threatened by the Commonwealth of Virginia, including the Henslow's sparrow (*Ammodramus henslowii*), Wilson's plover (*Charadrius wilsonia*), gull-billed tern (*Sterna nilotica*), loggerhead shrike (*Lanius ludovicianus*), and peregrine falcon (*Falco peregrinus*). The Henslow's sparrow is a Federal species of concern (LaRC 2005).

3.1.7.7 Socioeconomics

This section addresses the existing socioeconomic conditions and characteristics in the LaRC regional area. The LaRC regional area is defined here as the land area within an 80.5-km (50-mi) radius of LaRC, which includes portions of the Norfolk-Virginia Beach-Newport News, Virginia-North Carolina Metropolitan Statistical Area (MSA) known as Hampton Roads. The regional area includes the cities of Hampton, Poquoson, Newport News, and Williamsburg; and James City County and York County in Virginia (USBC 2006a).

3.1.7.7.1 Population

The total population within the LaRC regional area was approximately 1,680,980 persons in 2000 (see Table 3-9) (USBC 2006a). The total population is expected to increase to approximately 1,847,160 by 2010 and to approximately 2,005,170 by 2020. Similar increases are anticipated in the city of Hampton, where the total population was approximately 146,440 persons in 2000 and is expected to increase to approximately 160,910 by 2010 and to approximately 174,680 by 2020 (USBC 2000).

In 2000, minority race populations represented approximately 38 percent of the total population within the LaRC regional area and approximately 50 percent of the total population within the city of Hampton. The Black or African American population was the largest minority group

living within the regional area and the city of Hampton in the year 2000. Between 2000 and 2020, minority race populations are expected to increase to 43 percent of the total population within the LaRC regional area and approximately 54 percent of the total population within the city of Hampton. The Black or African American population is estimated to remain the largest resident minority group within the LaRC regional area and the city of Hampton in 2020 (USBC 2000, USBC 2006a).

Table 3-9. Population of the LaRC Regional Area and the City of Hampton for 2000, 2010, and 2020

Population	LaRC Regional Area			City of Hampton		
	2000	2010*	2020*	2000	2010*	2020*
White	1,045,141	1,103,827	1,152,707	72,556	76,630	80,024
Black or African American	528,894	610,382	694,046	65,428	75,509	85,858
American Indian and Alaska Native	7,178	7,546	8,481	616	648	728
Asian	43,403	59,524	75,805	2,694	3,695	4,705
Native Hawaiian and Other Pacific Islander	1,349	1,850	2,356	136	187	238
Some other race	19,257	23,370	27,624	1,505	1,826	2,159
Two or more races	35,759	—	—	3,502	—	—
Hispanic or Latino (of any race)	50,648	69,979	90,454	4,153	5,738	7,417
Total Population	**1,680,981**	**1,847,159**	**2,005,174**	**146,437**	**160,913**	**174,679**
Percent Minority	**37.83**	**40.24**	**42.51**	**50.45**	**52.38**	**54.19**

Sources: USBC 2000, USBC 2006a

* Projected population values for 2010 and 2020 do not represent absolute limits to growth; for any group, the future population may be above or below the projected value.

Note: Because an individual may report more than one race, the aggregate of the population groups may not match the total population.

3.1.7.7.2 Economy

Industrial sectors in the LaRC regional area that provide significant employment include education, health, and social services; retail trade; manufacturing; and professional, scientific, management, administrative, and waste management services. An estimated 1,290,227 people were employed in the LaRC regional area in 2000 with an estimated unemployment rate of 5.6 percent. The national and Virginia unemployment rates during the same period were estimated at 5.8 and 4.2 percent, respectively. The estimated percent of persons living below the poverty level (low-income persons) in 2000 was as follows: U.S. – 12.4 percent, Virginia – 9.6 percent, LaRC regional area – 10.4 percent, and the city of Hampton – 10.3 percent (USBC 2006a).

LaRC contributes significantly to the local, state, and national economies. In 2004, LaRC contributed $194 million to the Hampton Roads economy, $252 million to the economy of the Commonwealth of Virginia, and $505 million to the national economy. The total direct and

indirect impact in fiscal year 2004 was more than $2.61 billion (LaRC 2006). In 2006, LaRC's budget was $702 million and LaRC employed 1,960 civil servants and 1,500 support contractors. The vast majority of LaRC's workforce lives in the Yorktown area, Hampton, Newport News, Poquoson, and the Williamsburg area (LaRC 2006).

3.1.7.7.3 Transportation

LaRC has fully developed infrastructure, including road access and all utilities to support its occupational needs. The region is supported by a network of Federal, state, and county roads; cargo and passenger rail service; two major airports; and a seaport with cargo and cruise terminals (LaRC 2005).

3.1.7.7.4 Public and Emergency Services

NASA has contracted a private company to provide 24-hour police protection. Additional law enforcement is provided by the city of Hampton. Fire protection service is provided by the LaRC fire department and the city of Hampton fire department. The surrounding communities support four general hospitals, two specialty hospitals, and three military hospitals. In addition, a health clinic for LaRC staff and other personnel is available at LaRC.

3.1.7.8 Cultural Resources

The Lunar Landing Research Facility/Impact Dynamics Research Facility (Gantry) (Building 1297) is designated as a National Historic Landmark (DOI 2007a, DOI 2007b). The historic status of additional facilities that would be used by the Constellation Program will be determined after the on-going eligibility surveys have been completed.

There are no known archeological resources associated with Constellation Program activities.

3.1.7.9 Hazardous Materials and Waste

LaRC uses hazardous materials for various research activities, which in turn generate hazardous wastes. LaRC is classified as a large-quantity generator of hazardous waste and is managed under RCRA Subtitle C. In 2004, LaRC generated 9,226 kg (20,339 lb) of hazardous wastes and 6,792 kg (14,974 lb) of regulated waste. Such wastes are disposed of offsite at certified hazardous disposal facilities by a licensed contractor. All hazardous materials and waste are managed in accordance with applicable Federal, state, and local rules and regulations and the LaRC Waste Management Program (LaRC 2005).

LaRC was jointly listed with LAFB on the CERCLA National Priorities List in 1994 (EPA 2006c). Brick Creek Kiln has been listed as a CERCLA site and is being studied for remediation (see Section 3.1.7.3 for more details on remediation activities).

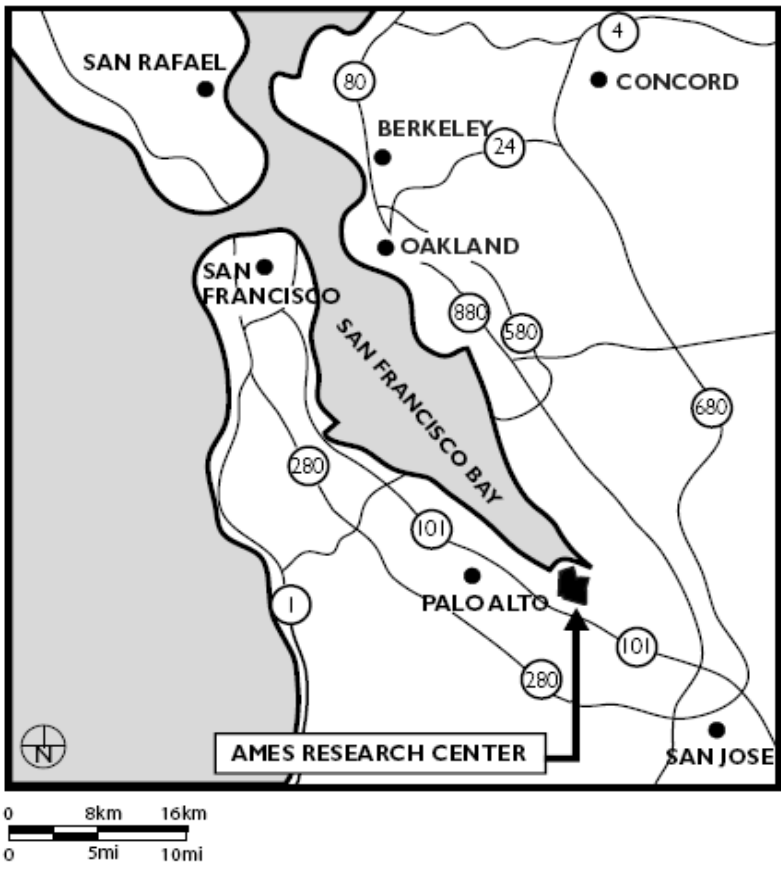
Nonhazardous/municipal solid wastes are collected and hauled by a contractor to EPA-approved offsite disposal facilities. LaRC has no active landfills (LaRC 2005).

3.1.8 Ames Research Center

NASA's ARC primarily engages in the areas of information technology, nanotechnology, fundamental space biology, biotechnology, aerospace and thermal protection systems, and human factors research. For the Constellation Program, ARC would lead Orion Thermal Protection System development.

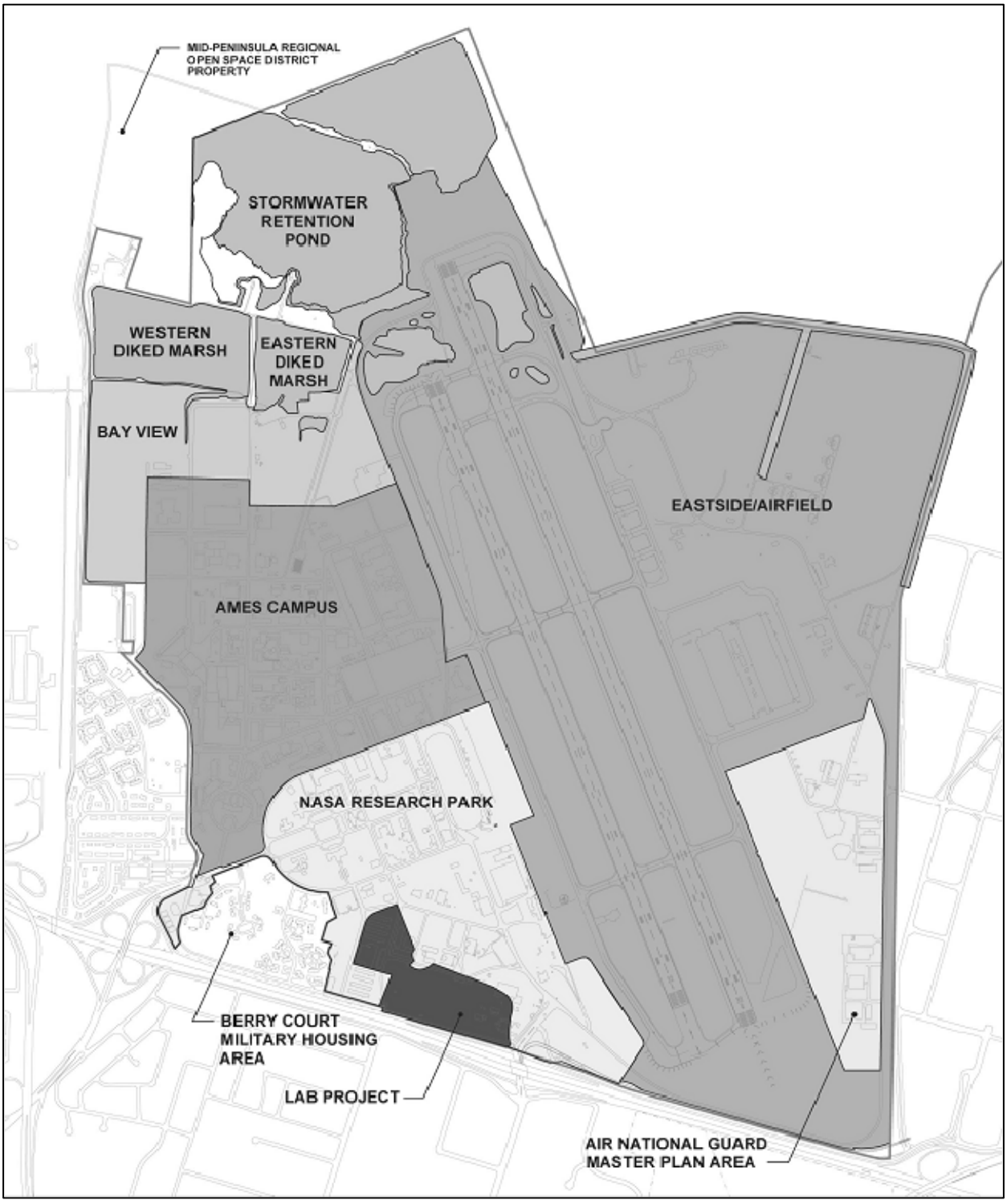
3.1.8.1 Land Resources

ARC encompasses approximately 800 ha (2,000 ac) in the northern portion of Santa Clara County, California, approximately 56 km (35 mi) south of San Francisco and 16 km (10 mi) north of San Jose (see Figure 3-18). ARC adjoins public access and wildlife protected areas, commercial and industrial sites, and residential areas of the cities of Mountain View and Sunnyvale. Land use at ARC is classified as industrial and is composed of the Ames Research Campus, the NASA Research Park, an airfield and support facilities, barracks, support facilities (active and inactive) for military personnel, and open space (see Figure 3-19) (ARC 2005).



Source: ARC 2002a

Figure 3-18. ARC Location and Vicinity Map



Source: ARC 2002a

Figure 3-19. ARC Land Use Map

NASA supports a wide-array of facilities at ARC, including wind tunnels, motion-based flight simulators, atmosphere-entry heat simulators, advanced digital computation systems, and free flight ballistic test facilities. In addition, there are a range of well-equipped ground-based and airborne laboratories that are dedicated to the study of solar and geophysical phenomena, life synthesis, life detection, and life environmental factors. ARC also has a number of support buildings, including aircraft hangers, machine shops, warehouses, a cafeteria, a post office, and numerous office buildings (ARC 2005).

In August 2002, NASA published the *Final Programmatic Environmental Impact Statement for the NASA Ames Development Plan* (67 *FR* 161). The NASA Ames Development Plan (NADP) provides for a collaborative effort among NASA, universities, and businesses to develop educational, office, research and development, museum, conference center, housing, and retail space in the Research Park area, as well as new development (primarily housing) in the Bay View area. The NADP also includes new high-density office and research and development space on the Ames Campus. It is estimated that implementation of planned development and activities under the NADP will add 7,088 new private-sector employees, approximately 3,000 students, and house 4,909 residents in 1,930 housing units within the ARC (ARC 2002b).

3.1.8.2 Air Resources

3.1.8.2.1 Climate

The climate at ARC is characterized by warm, dry summers and cool, wet winters with average annual temperatures ranging from 42 to 75°F (6 to 25°C). The average annual rainfall is approximately 35 cm (13.5 in). Wind prevails generally from the north-northwest during daytime hours and from the south in the evening and during colder months (ARC 2005).

3.1.8.2.2 Air Quality

Air quality at ARC is regulated through the NAAQS promulgated under the CAA, as well as the California Ambient Air Quality Standards. See Section 3.1.1.2 for a discussion of primary and secondary air quality standards and criteria pollutants. Air quality in California is controlled on a regional basis with factors such as climate, meteorology, topography, vegetation, land use, population, and growth projections considered when setting air quality control regions. An air quality control region may include whole or parts of counties. ARC is in the Bay Area Air Quality Management District, which includes nine whole and partial counties of the San Francisco Bay Area, including Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, southwestern Solano, and southern Sonoma Counties.

ARC is not required to operate under a CAA Title V permit. ARC qualifies as a synthetic minor source because its air emissions are limited below the prescribed thresholds by its state operating permit. Sources of air emissions, other than mobile sources such as automobiles and construction equipment, include boilers, internal combustion engines, solvent cleaning, aircraft engine testing, laser seeding operations, coating activities, oil/water separation, and tub grinding. The largest sources of emissions at ARC are vehicular traffic and aircraft operations. ARC has an operating permit from the Bay Area Air Quality Management District (BAAQMD 2005).

The Bay area is classified as a nonattainment area for the state ozone, PM_{10} and $PM_{2.5}$ air quality standards (CARB 2007). Furthermore, the Bay area has been designated as a marginal nonattainment area for the 8-hour ozone NAAQS. The Bay area also is classified as a maintenance area for carbon monoxide (CO) (EPA 2007c).

3.1.8.3 Water Resources

3.1.8.3.1 Potable Water

ARC receives its potable water and fire protection water supply from the San Francisco Water Department. The annual water demand in 2005 was approximately 901 megaliters (238 million gal) (ARC 2005).

3.1.8.3.2 Surface Water

There are three major surface water bodies in the vicinity of ARC. The San Francisco Bay is located approximately 1.6 km (1 mi) north of ARC, Stevens Creek forms the western boundary of ARC, and the Guadalupe Slough is located approximately 3.2 km (2 mi) northeast of ARC. The northeastern portion of ARC is classified as a wetland area, composed primarily of a stormwater retention pond and dike marshes (ARC 2005).

ARC is in the Stevens Creek watershed, a tributary to South San Francisco Bay, but historical surface water drainage patterns at the site have been modified substantially to manage runoff from impervious surfaces. Stormwater from the west side of the site is impounded at the north end of ARC, with excess peak runoff occasionally pumped into Stevens Creek. Stormwater from the east side of the campus discharges to the Moffett Channel, then to Guadalupe Slough, and ultimately into the Bay. Surface water flowing adjacent to ARC reflects water quality typical of urban or developed streams, where various types of point- and nonpoint-source pollutants affect water quality (ARC 2005).

Domestic wastewater at ARC is discharged to a sanitary sewer system and transported to an offsite treatment facility. An onsite industrial wastewater treatment facility is used to remove metals and dissolved solids from industrial wastewater and treated groundwater (ARC 2005).

The northern portion of ARC is within the 100- and 500-year tidal floodplains. The limit of 500-year tidal flooding at ARC is not significantly different from the 100-year limit because the elevation difference between the 100-year high tide and 500-year high tide is only approximately 0.08 m (0.25 ft). At present, however, the levees around the retention ponds and Stevens Creek protect ARC from tidal flooding (ARC 2005).

3.1.8.3.3 Groundwater

ARC is within the Santa Clara Valley groundwater basin, the largest groundwater basin adjoining the San Francisco Bay. Historically, groundwater was a major source of municipal, industrial, and agricultural water for Santa Clara County. Today, groundwater provides only approximately 50 percent of the county's total water supply. Although there are several aquifers

present in the subsurface at ARC, they are no longer used for domestic, municipal, or industrial water supply (ARC 2005).

Groundwater beneath ARC has been substantially affected by the Middlefield-Ellis-Whisman Superfund site in neighboring Mountain View, and by chemical spills and releases associated with U.S. Navy and NASA operations. The Moffett Naval Air Station, which transferred to NASA in 1994, was placed on the CERCLA National Priorities List in 1987. The main groundwater contaminants include TCE, perchloroethylene, 1,1,1-trichloroethane, cis- and trans-1,2-dichloroethene, 1,1-dichloroethane, 1,1-dichloroethene, dichlorobenzene, chloroform, Freon® 113, phenol, and vinyl chloride. Remediation efforts are ongoing (ARC 2005).

3.1.8.4 Ambient Noise

Noise generated by wind tunnels and aircraft operations at ARC and Moffett Field has historically been a source of complaints from the surrounding residents. Among NASA's wind tunnels, the primary noise generators include the 40- by 80-ft Wind Tunnel, the 80- by 120-ft Wind Tunnel, the Unitary Plan Wind Tunnels, and the 12-ft Pressure Wind Tunnel. In addition to the wind tunnels, the Outdoor Aerodynamic Research Facility, the Arc Jet Complex, and the airfield operations have been known to generate noise that affects the surrounding communities. None of these noise sources are considered to be constant noise generators. The most notable source of ambient noise in the area is traffic on local highways (ARC 2005).

3.1.8.5 Geology and Soils

3.1.8.5.1 Geology

The ARC site is located on nearly flat topography at the north end of the Santa Clara Valley with elevations ranging from approximately 0.6 m (2 ft) below mean sea level near its northern boundary to approximately 10 m (33 ft) above mean sea level in the south end. The principal topographic features on the site are low levees constructed to protect roads and structures from Bay waters during high storm tides. Bedrock at the site is overlain by 460 m (1,495 ft) or more of alluvium and bay muds. ARC is located in one of the most seismically active regions of the U.S. Although the hazard of surface fault rupture at the site is probably low, the site could be subject to strong groundshaking as a result of an earthquake on any of the region's major faults, and could also experience liquefaction (ARC 2005).

3.1.8.5.2 Soils

The soils at ARC have been altered substantially by land uses during the past 100 years. The majority of the site's upland areas and portions of its wetlands now support artificial fill and/or impervious cover overlying native soils. Native soil typically is exposed only in the diked brackish marshes and open grasslands on the northwest portion of the site, and even in these areas some alterations related to land use constraints have occurred. Most of the soil at ARC is considered silty clay, which is characterized by its dark gray color, fine texture, poor drainage, moderate alkalinity, and high fertility (ARC 2005).

Previous activities at ARC have resulted in areas of soil contamination (*e.g.*, polyaromatic hydrocarbons, metals, PCBs, pesticides, and chlorinated solvents) which are managed under CERCLA (ARC 2005) (see Section 3.1.8.3 for more details).

3.1.8.6 Biological Resources

Nearly all of the existing habitat areas at ARC have been extensively disturbed by development, resulting in limited natural habitat. The primary habitat types at ARC include weed-dominated areas, disturbed areas, and urban landscaped areas. The northwestern portion of ARC contains the most diverse and least disturbed habitats, including coastal and seasonal salt marshes, freshwater and brackish marshes, coyote brush scrub, and unvegetated areas (including open water). Much of this area has been excluded from future development because of the presence of jurisdictional wetlands (ARC 2005).

Wildlife at ARC largely consists of birds from the nearby bay front and open water habitats, migratory birds, and several resident species of birds and small mammals (ARC 2005).

No special-status plants are known to occur in the ARC area. In addition, no designated critical habitat areas are within or near ARC. Approximately 14 state and federally endangered or threatened animal species are known to frequent ARC. However, only one special-status animal, the western burrowing owl (*Athene cunicularia hypugea*) (listed as a California Species of Concern), is known or expected to occur within the developed areas that make up the NASA Research Park and Ames Research Campus (ARC 2005).

3.1.8.7 Socioeconomics

This section addresses the existing socioeconomic conditions and characteristics in the ARC regional area. The ARC regional area is defined here as the land area within an 80.5-km (50-mi) radius of ARC, which includes Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara, Santa Cruz, and portions of Marin, Monterey, Sacramento, San Benito, San Joaquin, Solano, and Stanislaus Counties (USBC 2006a).

3.1.8.7.1 Population

The total population within the ARC regional area was approximately 6,222,130 persons in 2000 (see Table 3-10) (USBC 2006a). The total population is expected to increase to approximately 7,483,430 by 2010 and to approximately 8,500,590 by 2020. Similar increases are anticipated in Santa Clara County where the total population was approximately 1,682,585 persons in 2000 and is expected to increase to approximately 2,023,670 by 2010 and to approximately 2,298,725 by 2020 (USBC 2000).

In 2000, minority race populations represented approximately 44 percent of the total population within the ARC regional area and approximately 46 percent of the total population within Santa Clara County. The Hispanic or Latino (of any race) and Asian populations were the largest minority groups living within the ARC regional area and Santa Clara in 2000. Between 2000 and 2020, minority race populations are expected to increase to approximately 46 percent of the total population within the ARC regional area and approximately 48 percent of the total

population within Santa Clara County. The Asian population is estimated to be the largest resident minority group within the ARC regional area and Santa Clara County in 2020 (USBC 2000, USBC 2006a).

Table 3-10. Population of the ARC Regional Area and Santa Clara County for 2000, 2010, and 2020

Population	ARC Regional Area			Santa Clara County		
	2000	2010*	2020*	2000	2010*	2020*
White	3,509,759	3,957,201	4,629,831	905,660	1,021,118	1,194,684
Black or African American	469,769	525,717	614,076	47,182	52,801	61,676
American Indian and Alaska Native	38,171	41,592	47,925	11,350	12,367	14,250
Asian	1,253,682	1,733,353	2,323,772	430,095	594,654	797,206
Native Hawaiian and Other Pacific Islander	33,643	46,515	62,359	5,773	7,982	10,701
Some other race	609,198	798,935	1,040,567	204,088	267,652	348,601
Two or more races	307,904	—	—	78,437	—	—
Hispanic or Latino (of any race)	1,257,333	1,675,627	2,204,378	403,401	537,606	707,250
Total Population	**6,222,126**	**7,483,431**	**8,500,586**	**1,682,585**	**2,023,667**	**2,298,725**
Percent Minority	**43.6**	**47.1**	**45.5**	**46.2**	**49.5**	**48.0**

Sources: USBC 2000, USBC 2006a

* Projected population values for 2010 and 2020 do not represent absolute limits to growth; for any group, the future population may be above or below the projected value.

Note: Because an individual may report more than one race, the aggregate of the population groups may not match the total population.

3.1.8.7.2 Economy

Industrial sectors in the ARC regional area that provide significant employment include education, health, and social services; professional, scientific, management, administrative, and waste management services; manufacturing; and retail trade. An estimated 4,915,902 people were employed in the ARC regional area in 2000 with an estimated unemployment rate of 4.6 percent. The national and California unemployment rates during the same period were estimated at 5.8 and 7.0 percent, respectively. The estimated percent of persons living below the poverty level (low-income persons) in 2000 was as follows: U.S. – 12.4 percent, California – 14.2 percent, ARC regional area – 8.7 percent, and Santa Clara County – 7.4 percent (USBC 2006a).

The ARC regional area is a major center for high-technology development with one of the strongest economies in the U.S. ARC contributes significantly to this economy with an annual budget of approximately $775 million and a combined workforce of approximately 6,037 civil servants and support contractors (ARC 2005, ARC 2006). NASA supports roughly 66 percent of ARC's workforce, with a payroll of approximately $315 million (ARC 2005).

3.1.8.7.3 Transportation

ARC has fully developed infrastructure, including road access and all utilities to support its occupational needs. Transportation to and from ARC is predominantly by private automobile. There are currently no capacity issues on internal roads. However, U.S. Highway 101, located adjacent to the southern boundary of the facility, provides primary transportation access to the facility and is subject to high levels of congestion during morning and afternoon rush hours (ARC 2005) (see Figure 3-18). Public transportation to ARC is available via bus and light rail service from the surrounding areas. Commuter bicycle lanes are also available (ARC 2005).

3.1.8.7.4 Public and Emergency Services

NASA contracts a private company to provide 24-hour police protection. Fire protection service at ARC is provided through an agreement with the California Air National Guard. The Moffett Field fire department is also available to provide fire protection services in an emergency. In addition, ARC has a cooperative response agreement with all the city fire departments in Santa Clara County. A health unit for ARC staff and other personnel is available at ARC. Medical emergencies also can be handled by the Moffett Field fire department. In addition, the Santa Clara County paramedics can be called, if necessary (ARC 2005).

3.1.8.8 Cultural Resources

The Unitary Plan Wind Tunnel Complex (Building N227), which includes the 11-ft Transonic Tunnel (Building N227A), is a designated National Historic Landmark (DOI 2007a, DOI 2007b). The Arc Jet Laboratory (Building N238) is a facility that would be associated with the Constellation Program and is eligible for individual listing in the NRHP (ARC 2005).

There are no known archeological resources associated with Constellation Program activities.

3.1.8.9 Hazardous Materials and Waste

NASA, along with other resident agencies at ARC, uses a wide variety of hazardous materials for research and operations, resulting in generation of hazardous and nonhazardous wastes. ARC is classified as a large-quantity generator of hazardous waste and is managed under RCRA Subtitle C (ARC 2005). In 2006, ARC generated 764 mt (842 tons) of hazardous wastes. Such waste is managed in accordance with applicable Federal, state, and local rules and regulations and the ARC plan for managing hazardous materials and waste.

NASA has received informal action notices of RCRA permit violations over the past 2 years. An informal notice is an action by EPA or an authorized state that notifies the facility of a violation. This differs from formal action where significant noncompliance is detected, or the facility does not respond to an informal enforcement action (EPA 2006b). In addition, NASA has reported releases of dichlorodifluoromethane, Freon® 113, and xylene at ARC under the EPCRA Toxic Release Inventory Program.

Nonhazardous wastes are collected and transported by a contractor to EPA-approved offsite disposal facilities. ARC has no active landfills (ARC 2005).

3.1.9 White Sands Missile Range/Johnson Space Center White Sands Test Facility

WSMR is a multi-service facility managed by the U.S. Department of the Army to support research, development, testing, and evaluation of weapons and space systems. WSMR provides a variety of services to the Army, Navy, Air Force, NASA, and the Defense Nuclear Agency, and to other governmental agencies, approved commercial firms, and foreign governments. NASA's WSTF operates under JSC as a field test installation within the boundaries of WSMR with the primary purpose of providing test services to NASA for the U.S. Space Program. For the Constellation Program, WSMR would perform Orion abort flight test ground operations, launch pad abort testing, and flight ascent abort testing. During vehicle development and testing, WSTF would perform ground servicing and operational checkout of the Orion Launch Abort System flight tests. These tests would be coordinated with WSMR Range Safety. WSTF also would perform Ares Upper Stage hot fire engine verification testing of the Reaction Control System and Thrust Vector Control subsystems.

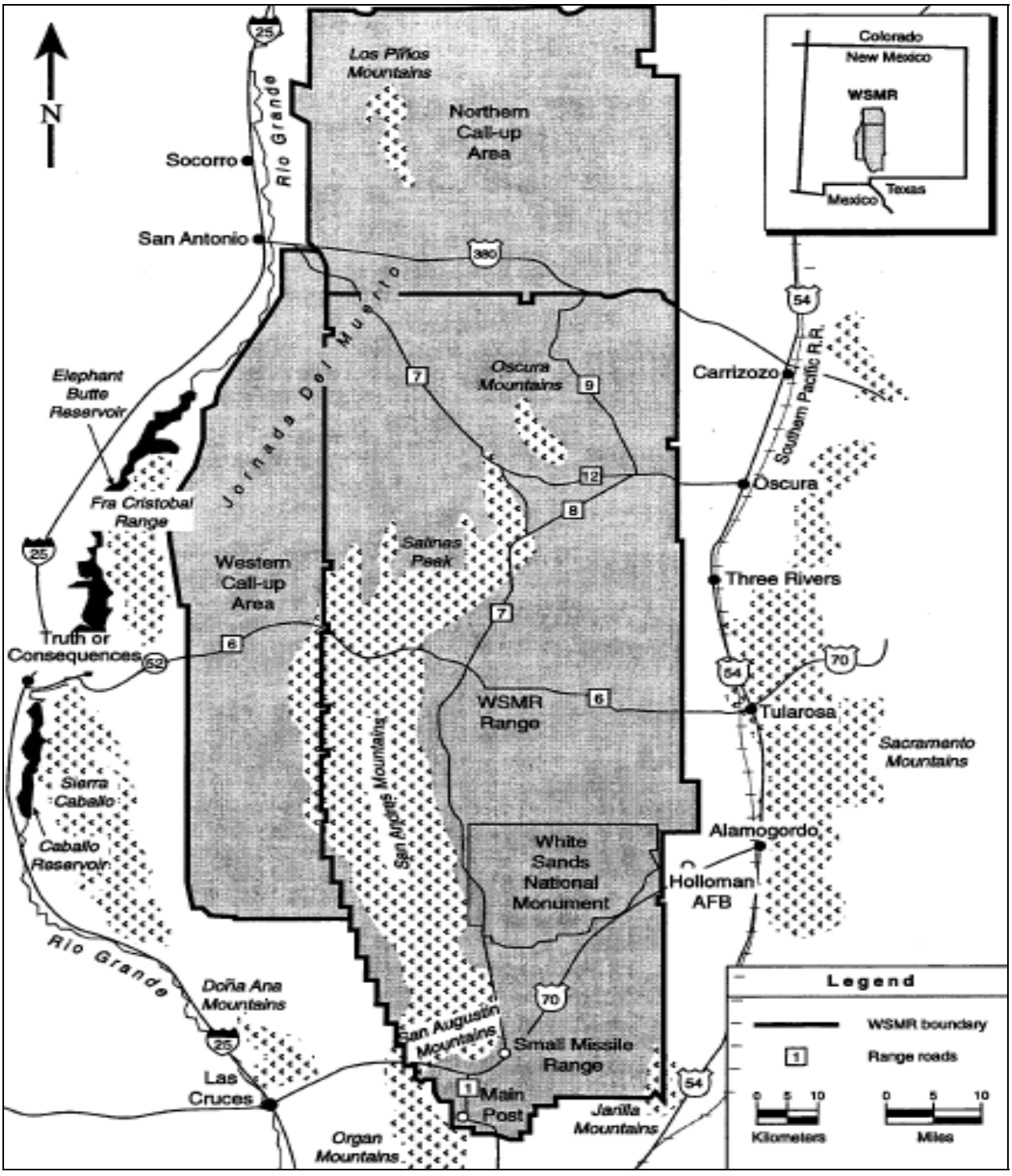
3.1.9.1 Land Resources

WSMR encompasses approximately 1.5 million ha (3.8 million ac) within the Tularosa Basin of south-central New Mexico (see Figure 3-20). The Main Post area, which serves as the center of operations for most organizations and tenants at WSMR, is located in the southern portion of WSMR approximately 32 km (20 mi) east of Las Cruces, New Mexico, and 72 km (45 mi) north of El Paso, Texas. WSMR extends into parts of five New Mexico counties and spreads almost 161 km (100 mi) north to south by 64 km (40 mi) east to west. WSMR is the Nation's largest military installation and one of the largest expanses of relatively undeveloped land remaining in the southwestern U.S. (WSMR 2001).

WSMR supports a central administrative and technical complex and more than 2,000 on-range test sites and facilities. Ongoing activities at WSMR include testing and evaluating missile systems, high-energy laser and directed energy systems, air defense fire-distribution systems, and space systems (WSMR 2001).

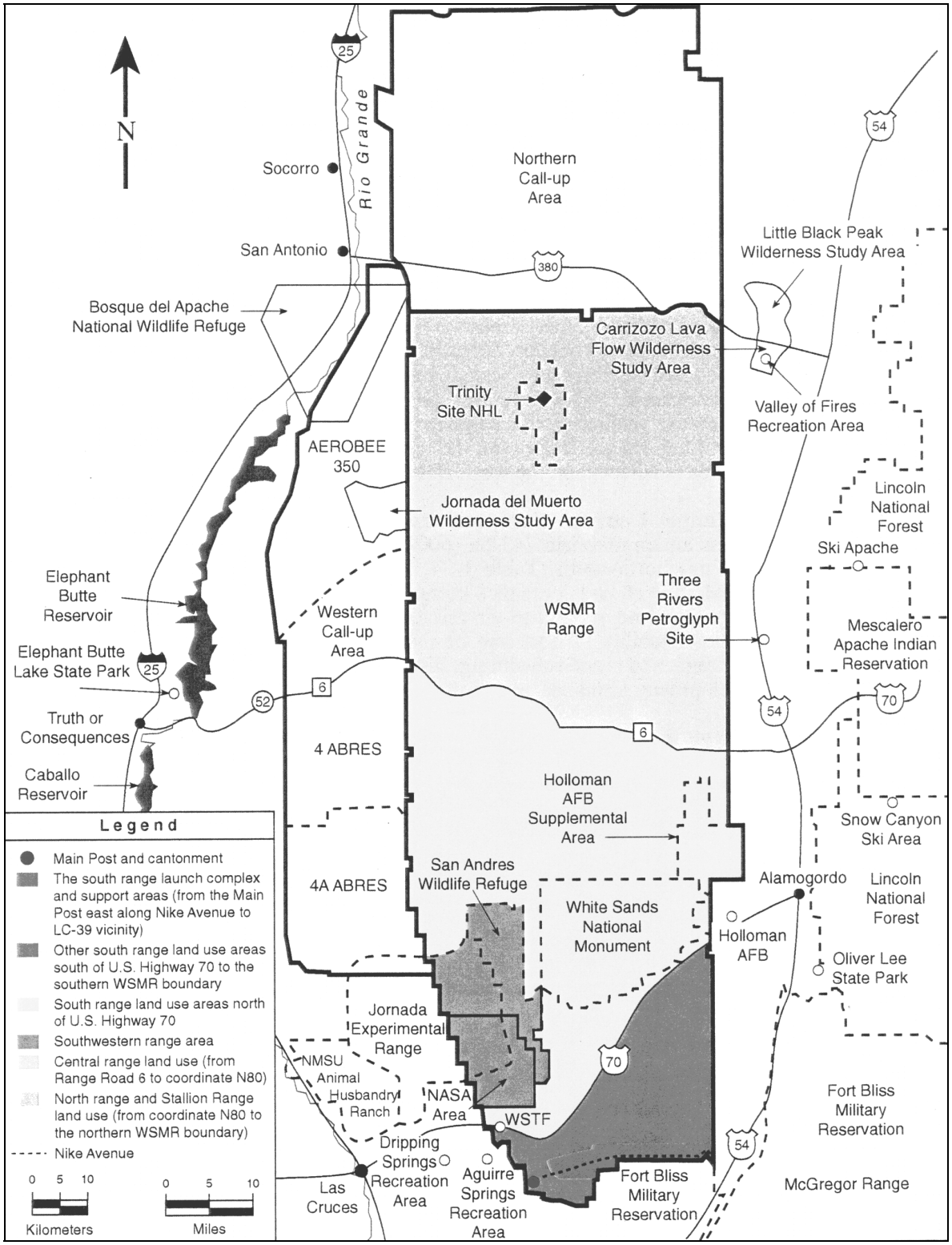
NASA's WSTF occupies approximately 24,483 ha (60,500 ac) of land near the southern boundary of WSMR, located entirely within Doña Ana County, New Mexico. To the west, WSTF is bounded by private lands, Bureau of Land Management land, and the Jornada Experimental Range. The vast majority of WSTF land area is utilized as a buffer zone (WSTF 2001). Other areas within WSMR, but managed independently of WSMR, include White Sands National Monument, San Andres Wildlife Refuge, and the Trinity Site National Historic Landmark. WSMR is bounded by several recreation, wilderness study, and wildlife refuge areas, Fort Bliss, Holloman AFB, and several private ranches and farms (see Figure 3-21) (WSMR 1998). The region surrounding WSMR is sparsely populated with most habitation concentrated in small rural villages and the Rio Grande River valley. Primary land uses are cattle grazing, recreation (predominantly hunting and sightseeing), and agriculture (ARL 1993).

The South Range Launch Complex and Support Areas would be the primary location used to support the Constellation Program (see Figure 3-21). This area encompasses approximately 243 ha (600 ac) and supports eight launch complexes (LC-32 to LC-38 and LC-50), located east of the Main Post. These complexes support a variety of missile test launches (WSMR 1998).



Source: WSMR 1998

Figure 3-20. WSMR Location and Vicinity Map



Source: WSMR 1998

Figure 3-21. WSMR Land Use Map

3.1.9.2 Air Resources

3.1.9.2.1 Climate

The climate at WSMR is typical of the northern Chihuahuan Desert, with hot summers and mild falls, winters, and springs. Average annual temperatures range from approximately 21 to 93°F (-6 to 34°C). Average annual precipitation on WSMR is 30 cm (12 in) and the relative humidity in the region is typically low, ranging from 29 to 55 percent over the course of a year. Prevailing wind direction varies throughout the year (WSMR 2001).

3.1.9.2.2 Air Quality

Air quality at WSMR is regulated through the NAAQS promulgated under the CAA. See Section 3.1.1.2 for a discussion of primary and secondary air quality standards and criteria pollutants. In addition to the Federal standards, the State of New Mexico has set forth, in Air Quality Control Regulation 20.2.3, ambient air quality standards (see Table 3-11) (NMED 2006a).

Table 3-11. New Mexico Air Quality Control Standards

Pollutant	Averaging Time	NAAQS (Primary Standards)	New Mexico Standards
Carbon Monoxide	8-hour [a]	9 ppm (10 mg/m^3)	8.7 ppm (9.97 mg/m^3)
	1-hour [a]	35 ppm (40 mg/m^3)	13.1 ppm (15.01 mg/m^3)
Lead	Quarterly Average	1.5 µg/m^3	none
Nitrogen Dioxide	Annual (Arithmetic Mean)	0.053 ppm (100 µg/m^3)	0.05 ppm (0.09 mg/m^3)
	24-hour	none	0.10 ppm (0.19 mg/m^3)
Particulate Matter (PM_{10})	24-hour [b]	150 µg/m^3	none
Particulate Matter ($PM_{2.5}$)	Annual [c] (Arith. Mean)	15.0 µg/m^3	none
	24-hour [d]	35 µg/m^3	none
Ozone	8-hour [e]	0.08 ppm	none
Sulfur Dioxide	Annual [a] (Arith. Mean)	0.03 ppm	0.02 ppm
	24-hour [a]	0.14 ppm	0.10 ppm
Total Suspended Particulate (TSP) Matter	24-hour	none	150 µg/m^3
	7-day average	none	110 µg/m^3
	30-day average	none	90 µg/m^3
	Annual geometric mean	none	60 µg/m^3

Source: NMED 2006a

[a] Not to be exceeded more than once per year.

[b] Not to be exceeded more than once per year on average over 3 years.

[c] To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m^3.

[d] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m^3.

[e] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

WSMR is classified as a major source of air emissions and operates under a CAA Title V permit (NMED 2006b). Within the WSMR area, industry, military operations, and transportation contribute to the atmospheric pollutant loading. Although all of WSMR is classified as an attainment area for all criteria pollutants regulated under the NAAQS and the New Mexico ambient air quality standards, exceedances of PM_{10} due to wind-blown dust have been recorded in Doña Ana County (NMED 2006a; EPA 2007c). In response to these exceedances, a Natural Events Action Plan has been developed for wind blown dust in Doña Ana County. As part of the Natural Events Action Plan, WSMR signed a Memorandum of Agreement with the New Mexico Environment Department in support of the Natural Events Action Plan (WSMR 2000).

3.1.9.3 Water Resources

3.1.9.3.1 Potable Water

WSMR receives all of its potable water from groundwater resources (WSMR 2001).

3.1.9.3.2 Surface Water

Surface water resources within WSMR are limited due to low rainfall, high evaporation rates, and high soil infiltration properties. Most streams, lakes, and rainwater catchments are ephemeral (not permanent) and are dependent on runoff from relatively infrequent precipitation events. Surface water generally occurs as overland flow from occasional intense thunderstorms during summer, accumulating in natural or constructed depressions (WSMR 2006). The only major perennial stream on WSMR is Salt Creek, located in the northwestern part of the Tularosa Basin. Most of the streams in the South Range Launch Complex and Support Areas originate in the mountains and flow to the east. Other surface drainage in this area occurs on alluvial fans of the Jarilla Mountains (WSMR 2001).

Surface water quality depends on the amount of snow accumulation in the mountainous areas, as well as the amount, intensity, and number of precipitation events. In general, much of the water found on WSMR contains high levels of minerals and salt. The surface water quality in intermittent water bodies ranges from fresh to brine, and can become more highly concentrated with total dissolved solids over time due to evaporation (WSMR 2001).

Sanitary wastewater and minor industrial discharges generated at the Main Post are treated onsite. Dewatered sludge is disposed of at an offsite commercial landfill. Discharge from the onsite treatment facility is monitored under a New Mexico Environmental Department Discharge Permit (WSMR 2001).

Approximately 3,816 ha (9,430 ac) on WSMR have been mapped as jurisdictional wetlands. The majority of these wetlands, approximately 3,590 ha (8,870 ac), were mapped as lacustrine wetlands, which are generally associated with ponds and lakes (WSMR 1998). LC-32, located within the South Range Launch Complex and Support Areas, is adjacent to the southern end of a large tract of designated wetland (WSTF 2007a).

3.1.9.3.3 Groundwater

Groundwater tables across WSMR vary from very near to the surface in the Tularosa Basin to more than 91 m (300 ft) deep in the Jornada Basin (WSMR 2001). The principal aquifer underlying the South Range Launch Complex and Support Areas occurs in the unconsolidated alluvium and basin fill of Tertiary and Quaternary Age (ARL 1993).

The major source of recharge for all aquifers in this region is snowmelt and precipitation runoff. The major sources of discharge are from evaporation, evapotranspiration, wells, springs, seeps, and Salt Creek (WSMR 2001). Water table contours in the Main Post area indicate that groundwater moves eastward out of the reentrant to the lower part of the basin east of the area. From there, it moves southeast toward the Hueco Bolson in Texas (WSMR 1998). The quality of groundwater in the area varies significantly. Overall, the water is categorized as fresh to slightly saline (WSMR 2001).

Voluntary site investigations at WSMR have identified multiple areas of surface water, soil, and groundwater contamination as a result of legacy actions. Many areas have been cleaned up or are under remediation. No known groundwater or surface water contamination exists near or at LC-32. The nearest active restoration site is at the Temperature Test Facility methylene chloride spill area, located approximately 4 km (2.5 mi) west of LC-32. This release never reached the groundwater and was contained in the vadose zone. In addition, a release of diesel fuel occurred at LC-38, located approximately 13 km (8 mi) east of LC-32. Soil contamination occurred at this site, but no groundwater contamination has been recorded. Additional contaminated sites can be found within the Main Post area (WSMR 2007).

3.1.9.4 Ambient Noise

Major sources of noise at WSMR include test firings of missiles, rockets, and space vehicles; sonic booms; ordnance explosions; low-altitude military jet traffic; aircraft drone overflights; gunfire; military helicopters; and general vehicle traffic (WSMR 2006).

Noise levels at the WSMR Main Post area boundaries (the only populated center within WSMR), at the WSMR southern property boundary, and at the San Andres National Wildlife Refuge (located approximately 19 km [12 mi] north of the Main Post area) have been estimated to be 55 to 65, 45 to 55, and 45 dBA, respectively. The Main Post area noise levels are estimated to fall in roughly the same noise level ranges as the urban areas of Holloman AFB and Alamogordo, New Mexico. Noise experienced by personnel on post would be typical of other rural or suburban communities. Personnel on the WSMR Main Post working in areas where occupational noise levels exceed 85 dBA are required to wear ear protection (WSMR 1998).

3.1.9.5 Geology and Soils

3.1.9.5.1 Geology

WSMR lies within an area defined by alternating uplifting fault blocks forming mountains and mesas, and downthrown blocks forming drainage basins. Two large basins occur on WSMR:

the Jornada del Muerto, west and northwest of the San Andres Mountains, and the Tularosa, east of the San Andres Mountains. The Tularosa Basin ranges in elevation from 1,182 to 3,645 m (3,878 to 11,958 ft) and the Jornada del Muerto Basin ranges from 1,406 to 2,607 m (4,613 to 8,553 ft). The San Andres Mountains, the most prominent mountain range on WSMR, traverse the west side of the Tularosa Basin (which is 129 km [80 mi] long) and rise more than 1,548 m (5,079 ft) above the basin's lowest point (WSMR 2001). Erosion of the uplifted fault blocks and subsequent depositional processes have resulted in thick sequences of alluvial material within the basins (WSMR 1998).

The South Range Launch Complex and Support Areas are located in the Main Post/Lower Tularosa Basin. There are two principal geomorphic structures in this area: the piedmont slopes located near the western and southeastern boundaries of the Lower Tularosa Basin and the expansive and hummocky basin floor that merges upward to the margins of the slopes. The piedmont surfaces vary in composition because of the influence of the distinct stratigraphy of the three mountain ranges, the Organ, San Augustin, and Jarilla Mountains (WSMR 2001). In general, the surficial geology of this area consists of wind-deposited (sand and silt) dunes that range from 1.2 to 6.1 m (4 to 20 ft) in height (ARL 1993).

3.1.9.5.2 Soils

The diversity of soil types represented at WSMR is a function of the varying topography and soil formation processes in the region. Soils identified at WSMR include the gypsum dunes and lake deposits of White Sands National Monument and the Lake Lucero area, the rocky soils associated with the rough foothills and slopes of the neighboring mountains, and the sandy loams of the Tularosa Basin and the Jornada del Muerto (WSMR 1998).

Soils in the South Range Launch Complex and Support Areas are described as sands to loams and are characterized by slow runoff and permeabilities ranging from slow to very rapid. The soils are highly susceptible to wind erosion in the area (WSMR 1998).

Voluntary site investigations at WSMR have identified widespread areas of surface water, soil, and groundwater contamination as a result of legacy actions (see Section 3.1.9.3 for more details).

3.1.9.6 Biological Resources

WSMR lies entirely within the Basin and Range Section of the Chihuahuan Semi-desert Ecoregion, except for the extreme northeast corner, which barely extends into the Arizona-New Mexico Mountains Ecoregion. Variations in elevation and topography control much of the broad distribution of vegetation types at WSMR. The lowland areas of the Tularosa and Jornada del Muerto basins consist primarily of shrublands and grasslands and the higher elevations of the San Andres and Oscura Mountains support woodlands and coniferous forest. The South Range Launch Complex and Support Areas are dominated by basin shrublands and are part of a broad, extensive dune field of mesquite coppice dunes that extend south into Texas and Chihuahua, Mexico (WSMR 2001).

The diversity of habitats and quality of vegetation communities at WSMR support more than 70 mammal species, nearly 300 avian species, and a wide assortment of reptile and amphibian

species. The only fish species native to WSMR is the White Sands pupfish. Many of the structures at the South Launch Complex are known to be used by birds, especially raptors and bats (WSMR 2001).

A total of 61 plant species and 25 animal species having Federal or state protected status occur or potentially occur on WSMR (WSMR 2006). Four federally and state listed species of concern, the Organ Mountain evening primrose (*Oenothera organensis*), mosquito plant (*Agastache cana*), Vasey's bitterweed (*Hymenoxys vaseyi*), and American Peregrine Falcon (*Falco peregrinus anatum*), have documented occurrences within the Main Post/Lower Tularosa Basin area. Two state-listed endangered species, the Desert night-blooming cereus (*Peniocereus greggii var. greggii*) and the American Peregrine Falcon (*Falco peregrinus anatum*), have documented occurrences within the Main Post/Lower Tularosa Basin area (WSMR 2001). In addition, the desert bighorn sheep (*Ovis canadensis mexicana*), a state-listed endangered species, has documented occurrences within WSTF (WSTF 2001). There are no documented occurrences of federally threatened or endangered species within the Main Post/Lower Tularosa Basin area (WSMR 2001).

3.1.9.7 Socioeconomics

This section addresses the existing socioeconomic conditions and characteristics in the WSMR regional area. The WSMR regional area is defined here as the land area within an 80.5-km (50-mi) radius of WSMR, which includes Doña Ana County and portions of Luna, Sierra, and Otero Counties in New Mexico, as well as portions of El Paso County, in Texas (USBC 2006a).

3.1.9.7.1 Population

The total population within the WSMR regional area was approximately 462,370 persons in 2000 (see Table 3-12) (USBC 2006a). The total population is expected to increase to approximately 545,320 by 2010 and to approximately 635,840 by 2020. Similar increases are anticipated in Doña Ana County, where the total population was approximately 174,680 persons in 2000 and is expected to increase to approximately 206,020 by 2010 and to approximately 240,220 by 2020 (USBC 2000).

In 2000, minority race populations represented approximately 28 percent of the total population within the WSMR regional area and approximately 32 percent of the total population within Doña Ana County. The Hispanic or Latino (of any race) population was the largest minority group living within the WSMR regional area and Doña Ana County in 2000. Between 2000 and 2020, minority race populations are expected to increase to 33 percent of the total population within the WSMR regional area and approximately 37 percent of the total population within Doña Ana County. The Hispanic or Latino (of any race) population is expected to remain the largest resident minority group within the WSMR regional area and Doña Ana County in 2020 (USBC 2000, USBC 2006a).

Table 3-12. Population of the WSMR Regional Area and Doña Ana County for 2000, 2010, and 2020

Population	WSMR Regional Area			Doña Ana County		
	2000	2010*	2020*	2000	2010*	2020*
White	332,748	379,582	426,408	118,478	135,154	151,827
Black or African American	18,343	24,096	30,378	2,723	3,577	4,510
American Indian and Alaska Native	4,630	5,666	6,890	2,580	3,158	3,839
Asian	6,310	8,635	11,020	1,330	1,820	2,323
Native Hawaiian and Other Pacific Islander	565	773	987	117	160	204
Some other race	83,293	103,534	127,378	43,209	53,709	66,078
Two or more races	16,479	—	—	6,245	—	—
Hispanic or Latino (of any race)	277,249	343,194	421,943	110,665	136,987	168,420
Total Population	**462,368**	**545,324**	**635,836**	**174,682**	**206,023**	**240,218**
Percent Minority	**28.03**	**30.39**	**32.94**	**32.18**	**34.40**	**36.80**

Sources: USBC 2000, USBC 2006a

* Projected population values for 2010 and 2020 do not represent absolute limits to growth; for any group, the future population may be above or below the projected value.

Note: Because an individual may report more than one race, the aggregate of the population groups may not match the total population.

3.1.9.7.2 Economy

Industrial sectors in the WSMR regional area that provide significant employment include education, health, and social services; retail trade; manufacturing; and arts, entertainment, recreation, accommodation, and food services. An estimated 336,509 people were employed in the WSMR regional area in 2000 with an estimated unemployment rate of 8.2 percent. The national and New Mexico unemployment rates during the same period were estimated at 5.8 and 7.3 percent, respectively. The estimated percent of persons living below the poverty level (low-income persons) in 2000 is as follows: U.S. – 12.4 percent, New Mexico – 18.2 percent, WSMR regional area – 21.3 percent, Doña Ana County – and 24.7 percent (USBC 2006a).

WSMR contributes significantly to the local, state, and national economies. WSMR directly commits approximately $350 million per year into the economy of the region, including monies from salary and local contract dollars. In 2002, WSMR employed 2,553 civil servants, 508 military personnel, and 3,150 support contractors. The vast majority of WSMR's workforce lives in the Las Cruces area, followed by the El Paso area, WSMR proper, and the Alamogordo area (WSMR 2006). In 2006, WSTF had approximately 600 persons working for NASA and various contractors (MSFC 2007d, WSTF 2001).

3.1.9.7.3 Transportation

WSMR has fully developed infrastructure, including road access and all utilities to support its occupational needs. An extensive network of roads and highways in southern New Mexico provides interstate and local access to all parts of WSMR. WSMR is bounded by U.S. Highway 380 to the north and U.S. Highway 54 to the east. U.S. Highway 70 crosses the southern portion of WSMR. There are seven primary entry points onto WSMR and an extensive system of limited-access roads have been developed and maintained by WSMR (WSMR 2001).

There are several government-owned aircraft landing facilities within and adjacent to WSMR and commercial aircraft services are available within a short drive. No rail system exists within WSMR; however, a major rail line runs along the entire length of WSMR's eastern boundary (WSMR 2001).

3.1.9.7.4 Public and Emergency Services

WSMR provides personnel with a variety of community services, including security, fire protection, and emergency response capabilities. Most of the personnel providing these services are based at the Main Post. Health facilities are available through the onsite health clinic. For off-range areas of the region, public safety and health services are provided by local jurisdictions (city and county) (WSMR 2001).

3.1.9.8 Cultural Resources

The Trinity Site, located in the north-central portion of WSMR, is recognized as a World Heritage Site and as a National Historic Landmark (DOI 2007a, DOI 2007b). The V-2 Launching Site, located in the South Range Complex, is a designated National Historic Landmark (DOI 2007b). LC-33 is listed in the NRHP and the White Sands National Monument is listed as a historic district in the NRHP (DOI 2007a).

The White Sands National Monument and the Parabolic Dune Hearth Mounds within the monument are both listed on the New Mexico State Register of Cultural Properties. In addition, the Mockingbird Gap site adjacent to WSMR is listed in New Mexico State Register of Cultural Properties (WSMR 1998).

Several Native American Traditional Cultural Properties, as designated by the NRHP, exist in the vicinity of WSMR. These properties are of primary interest to the Mescalero Apache, whose lands are on the northeastern periphery of WSMR. Available records indicated that mountainous regions in the northern portion of WSMR have been used as traditional religious sites by Native Americans (WSMR 1998).

3.1.9.9 Hazardous Materials and Waste

WSMR uses hazardous materials for various research and testing activities, which in turn generate hazardous wastes. WSMR is regulated both for generation and storage of hazardous wastes, for which it holds a RCRA Part B permit. In 2005, WSMR generated 35,380 kg (78,000 lb) of hazardous wastes (EPA 2005). Such wastes are disposed of offsite at certified hazardous disposal facilities by a licensed contractor. Furthermore, all hazardous materials and

waste are managed in accordance with applicable Federal, state, and local rules and regulations (ARL 1993).

Legacy actions involving hazardous materials and waste at WSMR have resulted in widespread areas of surface water, soil, and groundwater contamination (see Section 3.1.9.3 for more details).

There are two state-permitted landfills in operation at WSMR. However, domestic solid waste from the Main Post has been collected and transported off-range for disposal since 1997 (WSMR 2001).

3.1.10 Other U.S. Government Facilities

Other U.S. Government facilities that would support the Constellation Program include NASA's DFRC, GSFC, and JPL. Most of the activities that would be implemented at these facilities would be limited to engineering design and data analysis, component testing, project management, procurement, operational checkout, and administrative support. The Constellation Program also may use other U.S. Government facilities, such as U.S. Air Force's wind tunnels and other test facilities. The activities that would be expected to occur at these U.S. Government facilities would fall within the normal realm of operations at each facility. These activities would not be expected to result in environmental impacts. Therefore, the existing environments at these facilities are not addressed in detail in this Final PEIS. Any activities determined to be outside the scope of activities normally undertaken at these facilities would be subject to separate NEPA review and documentation, as appropriate.

DFRC is one of NASA's premier centers for aeronautical flight research and atmospheric flight operations. DFRC is located within the boundaries of Edwards Air Force Base (EAFB) in Kern County, California, approximately 105 km (65 mi) northwest of Los Angeles. DFRC leases three locations within EAFB, with an area of approximately 339 ha (838 ac). EAFB encompasses more than 121,406 ha (300,000 ac), which affords DFRC a considerable degree of isolation. There are no major urban areas within the immediate area (DFRC 2003). In 2006, DFRC had a total budget of approximately $174 million and employed 500 civil servants and 466 support contractors. For the Constellation Program, DFRC would lead the Orion abort flight test integration and operations, procure abort test boosters, and manage the flight test article development and integration.

NASA's GSFC conducts scientific investigation, development, and operation of space systems, and development of related technologies. GSFC's main facility is located approximately 11 km (7 mi) northeast of Washington, DC in Prince George's County, Maryland. The Center encompasses approximately 514 ha (1,271 ac) of land and is surrounded by the town of Greenbelt to the west and southwest and the community of Glenn Dale to the southeast. The areas to the west, south, and east of GSFC are residential. Property that bounds GSFC to the north is government-owned. The GSFC main facility contains more than 50 buildings that support administration, research, design and construction of spacecraft, spacecraft operations, information storage and archival, data analysis, maintenance, utilities, and tracking and communication operations (GSFC 2005). In 2006, GSFC had a total budget of approximately $2.9 billion and employed 3,277 civil servants and 2,750 support contractors. For the

Constellation Program, GSFC would provide communications and tracking for the Orion spacecraft and Ares I and Ares V launch vehicles. GSFC also would provide systems engineering, integration, safety, reliability, quality assurance, test and verification support at the Program and Project level.

JPL is managed by the California Institute of Technology for NASA. JPL's primary mission is the planning and execution of robotic science missions throughout the Solar System. JPL's main facility encompasses approximately 71 ha (176 ac) of land in northwestern Pasadena in Los Angeles County, California. To the north are the San Gabriel Mountains and Angeles National Forest, to the east is the Arroyo Seco Canyon, to the south is the Los Angeles Metropolis, and to the west is the city of La Cañada-Flintridge. JPL resembles a university campus by appearance with offices and laboratory facilities for research and development work (JPL 2002). For fiscal year 2007, JPL has a total operating budget of $1.6 billion and employs 5,463 persons. JPL created a total economic impact of $2.66 billion in output, $904 million in income, and 16,254 jobs in 2006 (JPL 2006). For the Constellation Program, JPL would provide support for mission operations, the Orion Thermal Protection System, and systems engineering, integration, testing, and verification.

3.2 COMMERCIAL FACILITIES

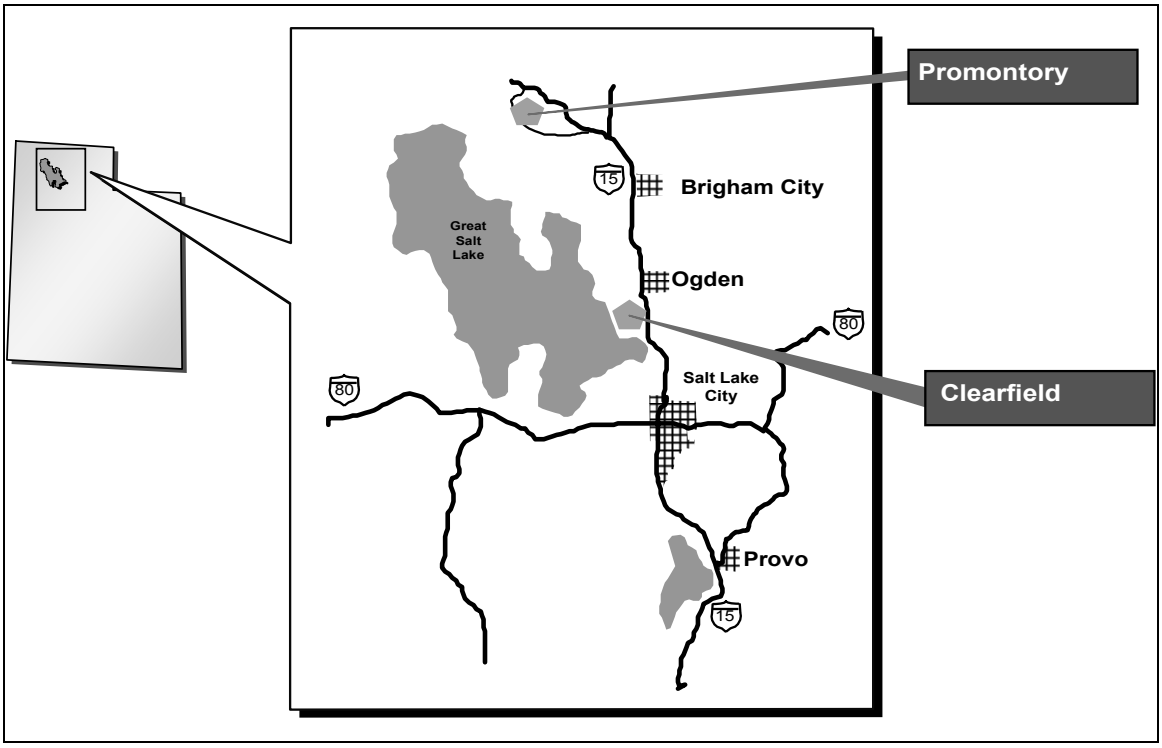
3.2.1 Alliant Techsystems-Launch Systems

ATK provides manufacturing and testing services for rocket systems for space launch vehicles. For the Constellation Program, ATK would provide solid rocket motor development, testing, and production for the Ares launch vehicles. ATK may perform additional work for the Constellation Program awarded through competitive procurements.

3.2.1.1 Land Resources

Activities associated with the five segment reusable solid rocket motor for the Constellation Program would occur at two ATK locations in Utah, including ATK-owned facilities at Promontory, which is northwest of Brigham City, Utah, and at leased facilities at the Clearfield Refurbishment Center (CRC), which is southwest of Ogden, Utah (see Figure 3-22). The Promontory facility is located in Box Elder County northwest of Great Salt Lake and encompasses 8,054 ha (19,900 ac) of Great Basin range land. The Promontory facility consists of 535 buildings, approximately 250 of which are used for Space Shuttle and other NASA programs. The buildings encompass approximately 232,250 square meters (m^2) (2.5 million square feet [ft^2]) of manufacturing facilities and 27,870 m^2 (300,000 ft^2) of research and development laboratories. The test area that would support the Constellation Program is located near the southern end of the Promontory facility.

The Promontory facility has been ground test firing solid rocket motors since the late 1950s and continues to be used for mixing and casting solid propellant and for solid rocket motor assembly and testing. Solid rocket motors for Delta II and Delta IV launch vehicles, for Minutemen missiles, and the Space Shuttle are currently fabricated at this facility. Primary land use outside the central facility area, including much of the test area, propellant development area, and part of the south plant, is designated for livestock grazing (see Figure 3-23) (ATK 2006).



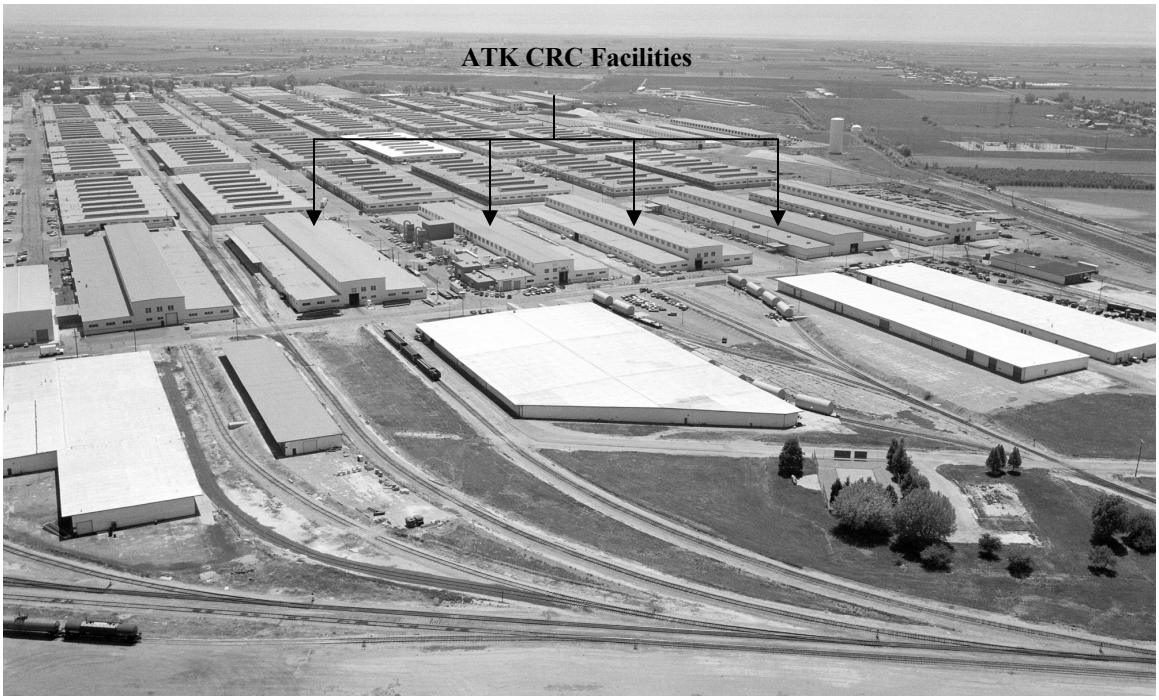
Source: ATK 2006

Figure 3-22. Location and Vicinity of ATK Facilities in Utah

Source: ATK 2006

Figure 3-23. Central Portion of the Promontory Facility

The CRC is located in Davis County, north of Salt Lake City in an industrial complex known as the Freeport Center (see Figure 3-24). The privately owned Freeport Center is a former U.S. Navy facility and presently hosts the CRC, other ATK operations outside of the Launch Systems Group, and numerous other industrial firms. ATK's CRC occupies seven buildings with approximately 65,030 m^2 (700,000 ft^2) of manufacturing and office space. The primary function of the CRC is refurbishment of the Space Shuttle's solid rocket motors and other spent hardware returning from flight. Activities include removal of residual insulation and paint, and testing of expended solid rocket motor flight hardware for reuse (ATK 2006).



Source: ATK 2006

Figure 3-24. ATK Facilities at Freeport Center

3.2.1.2 Air Resources

3.2.1.2.1 Climate

The climate in northern Utah is typical of middle latitude, semi-arid lands where evaporation potential exceeds precipitation throughout the year. The summers are considered hot and dry and winters are cold and often bring snow (Ogden 2007).

3.2.1.2.2 Air Quality

Air quality is regulated through the NAAQS promulgated under the CAA. See Section 3.1.1.2 for a discussion of primary and secondary air quality standards and criteria pollutants. The NAAQS for criteria pollutants have been adopted by the State of Utah.

Davis and Box Elder Counties are currently classified as attainment areas for all criteria pollutants regulated under the NAAQS (EPA 2007c). Davis County is classified as a

maintenance area for the 1-hour ozone standard. The Brigham City Metropolitan Statistical Area and the Ogden-Clearfield Metropolitan Area are likely to be designated as nonattainment areas under the 35 $\mu g/m^3$ 24-hour $PM_{2.5}$ NAAQS (UDAQ 2006a). Attainment under the 35 $\mu g/m^3$ 24-hour $PM_{2.5}$ standard is anticipated by April 2015 (EPA 2006e).

The Promontory facility is classified as a major source of air emissions and operates under a CAA Title V Permit. Primary activities associated with air emissions at the Promontory facility include the manufacturing and testing of solid rocket motor propellant, flare illuminants, and composite materials. The CRC is not classified as a major source of air emissions and is not required to operate under a CAA Title V Permit. Primary sources of air emissions at the CRC are solvents used during cleaning, and testing of expended solid rocket motor components (ATK 2006).

An ozone depleting substance, TCA, is used at Promontory as a component in solid rocket motor insulation and other critical bonding operations. NASA has an EPA exemption to use TCA, which is stockpiled under an essential use exemption (EPA 2007b). The TCA is stored in climate-controlled units with provisions for secondary containment in the event of a spill. Methylene chloride is used at the CRC as a cleaning agent in the solid rocket motor refurbishment activities. It is stored in a unit with a vapor recovery system. Both TCA and methylene chloride are distributed to workers in small quantities on an as-needed basis with management controls for distribution of the substances (ATK 2006).

3.2.1.3 Water Resources

3.2.1.3.1 Potable Water

The Promontory facility operates its own non-transient, non-community water system while CRC receive potable water from the local municipal water supply system.

3.2.1.3.2 Surface Water

The Promontory facility is located in a generally dry area with few springs and seasonal streams within the facility's boundaries. At least two of these springs, Pipe Springs and Shotgun Springs, are contaminated with TCE and perchlorate from historical waste management activities. This contamination is being addressed through a RCRA post-closure permit administered by the Utah Department of Environmental Quality. Multiple intermittent streams, which ultimately drain to the Great Salt Lake, and large tracts of marsh and wetland areas, can be found to the east and south of the Promontory facility (ATK 2006).

The Promontory facility operates two outfalls into Blue Creek under a Utah Pollutant Discharge Elimination System Permit for Wastewater Treatment and Discharge (number UT0024805) and a Utah Pollutant Discharge Elimination System Multi-Sector General Permit for Storm Water Discharge Associated with Industrial Activity (number UTR000529). The Promontory facility also operates under a Storm Water Pollution Prevention Plan and Stormwater Discharge Permit (number UTR000546) (ATK 2006).

The CRC is located within a concrete paved industrial complex that supports virtually no natural surface water. Wastewater at the CRC is treated and discharged to the local wastewater

treatment facility under an NPDES permit, or under a North Davis County Discharge Permit (number 150). Most water from washing operations is recovered and reused (ATK 2006).

The Promontory facility and CRC are not known to be within 100- or 500- year floodplains.

3.2.1.3.3 Groundwater

Groundwater in northern Utah flows primarily through fractured bedrock and faults. In terms of water quality, the water is naturally too salty for human or agricultural use. Groundwater underlying the Promontory facility is contaminated with perchlorate and TCE (and breakdown products) from historical waste management practices (ATK 2006).

A major source of groundwater pollution at the Promontory facility was eliminated in 1988, with the cessation of using the unlined M-136 liquid waste surface impoundments. The M-136 Liquid Thermal Treatment Area had been used for the management of wastewaters contaminated with explosives and solvents since 1962. The area was closed in 1991 under a State of Utah approved closure plan, by constructing low-permeable caps over the impoundment areas to minimize infiltration and control any further releases (ATK 2006).

Contaminated sites at the Promontory facility are being investigated and/or remediated under the direction of the State of Utah RCRA Program (ATK 2006).

3.2.1.4 Ambient Noise

The Promontory facility is located in the remote western desert, which provides a large separation from populated areas. Onsite buildings, operations, and areas that pose noise hazards require hearing protection. The nearest house to the Promontory facility is approximately 5 km (3 mi) away. Historically, noise complaints by the public have not been an issue at the Promontory facility.

The CRC is located in a high-density industrial complex. Areas where the noise levels can exceed 85 dBA have been identified and mapped. Hearing protection for onsite personnel is required in these areas. Typical noise levels in noise hazard areas range from 90 to 95 dBA with some activities that are between 100 and 105 dBA, such as grit blast operations. Most activities occur within enclosed structures and noise levels are significantly diminished before reaching populated areas. There are no sensitive noise receptors in the immediate vicinity of the CRC (ATK 2006).

3.2.1.5 Geology and Soils

The Promontory facility is located in a vast area of hilly and flat land dominated by rocks and boulders. The most extensive soil types in the proposed Constellation Program administration and manufacturing areas are Stingal and Hupp series. Sanpete and Sandall-Rock series are the two most extensive types in the motor test area. These major soil types generally have moderate to severe use limitations. The Soil Conservation Service has noted that slow permeability, land slopes, and shallow bedrock are reasons for the use limitations. Soils of these types are suitable primarily for range and wildlife habitat (ATK 2006).

Legacy actions at the Promontory facility have contributed to TCE and perchlorate contamination of soil. Remediation efforts are ongoing (see Section 3.2.1.3 for details).

The CRC is located on highly disturbed soils that once were used to support tomato fields. Much of the Freeport Center, which houses the CRC, is paved with concrete and has been significantly altered from its natural soil conditions (ATK 2006).

3.2.1.6 Biological Resources

The Promontory facility is located in a sparsely vegetated area dominated by bluebunch wheat grass and sagebrush. Various species of wildlife have been observed within the facility and the surrounding area, including more than 75 bird and 47 mammal species. There are no sensitive or critical habitats within or adjacent to the facility. In addition, there are no state or federally threatened or endangered species known to inhabit the Promontory facility. The federally protected bald eagle (*Haliaeetus leucocephalus*) and federally threatened snowy plover (*Charadrius alexandrinus)* have been reported in the vicinity (ATK 2006).

The CRC is located in a high-density industrial complex that supports little, if any, natural habitat for animal or plant life. Small landscaped areas may support a few bird and small mammal species. There are no sensitive or critical habitats within or adjacent to the CRC. In addition, there are no state or federally threatened or endangered species known to inhabit the CRC (ATK 2006).

3.2.1.7 Socioeconomics

This section addresses the existing socioeconomic conditions and characteristics in the Promontory and CRC regional areas. The Promontory regional area is defined here as the land area within an 80.5-km (50-mi) radius of the Promontory facility, which includes Box Elder, Cache, Weber, Davis, Morgan, and portions of Rich Counties in Utah, and Oneida and portions of Franklin, Bannock, and Cassia Counties in Idaho. The CRC regional area is defined here as the land area within an 80.5-km (50-mi) radius of the CRC, which includes Weber, Davis, Salt Lake, Morgan, and portions of Utah, Tooele, Box Elder, Cache, Rich, Summit, and Wasatch Counties in Utah (USBC 2006a).

3.2.1.7.1 Population

The total population within the Promontory regional area was approximately 496,255 persons in 2000 (see Table 3-13) (USBC 2006a). The total population is expected to increase to approximately 576,120 by 2010 and to approximately 636,850 by 2020 (USBC 2006a). Similar increases are anticipated in Box Elder County, where the total population was approximately 42,745 persons in 2000 and is expected to increase to approximately 49,620 by 2010 and to approximately 54,855 by 2020 (USBC 2000). In 2000, the U.S. Bureau of Census reported no residents within a 12.9-km (8-mi) radius of the Promontory's test areas (USBC 2006a).

In 2000, minority race populations represented approximately 10 percent of the total population within the Promontory regional area and approximately 7 percent of the total population within Box Elder County. The Hispanic or Latino (of any race) population was the largest minority group living within the Promontory regional area and Box Elder County in 2000. Between 2000 and 2020, minority race populations are expected to increase to 13 percent of the total population

within the Promontory Facility regional area and approximately 11 percent of the total population within Box Elder County. The Hispanic or Latino (of any race) population is expected to remain the largest resident minority group within the regional area and Box Elder County in 2020 (USBC 2000, USBC 2006a).

Table 3-13. Population of the Promontory Regional Area and Box Elder County for 2000, 2010, and 2020

Population	Promontory Regional Area			Box Elder County		
	2000	2010*	2020*	2000	2010*	2020*
White	446,836	508,993	552,592	39,699	45,221	49,095
Black or African American	5,560	7,544	9,067	71	96	116
American Indian and Alaska Native	3,497	4,426	5,184	375	475	556
Asian	7,542	10,214	12,537	409	554	680
Native Hawaiian and Other Pacific Islander	887	1,201	1,474	34	46	57
Some other race	22,221	29,704	36,866	1,473	1,969	2,444
Two or more races	9,712	—	—	684	—	—
Hispanic or Latino (of any race)	44,091	59,293	75,371	2,791	3,753	4,771
Total Population	**496,255**	**576,116**	**636,848**	**42,745**	**49,624**	**54,855**
Percent Minority	**9.96**	**11.65**	**13.23**	**7.13**	**8.87**	**10.50**

Sources: USBC 2000, USBC 2006a

* Projected population values for 2010 and 2020 do not represent absolute limits to growth; for any group, the future population may be above or below the projected value.

Note: Because an individual may report more than one race, the aggregate of the population groups may not match the total population.

The total population within the CRC regional area was approximately 1,562,100 persons in 2000 (see Table 3-14) (USBC 2006a). The total population is expected to increase to approximately 1,813,480 by 2010 and to approximately 2,004,655 by 2020. Similar increases are anticipated in Davis County where the total population was approximately 238,990 persons in 2000 and is expected to increase to approximately 277,455 by 2010 and to approximately 306,700 by 2020 (USBC 2000). In 2000, the population of Clearfield was approximately 25,970 persons and the population of Ogden was approximately 77,230 persons (USBC 2006a).

In 2000, minority race populations represented approximately 12 percent of the total population within the CRC regional area and approximately 8 percent of the total population within Davis County. The Hispanic or Latino (of any race) population was the largest minority group living within the CRC regional area and Davis County in 2000. Between 2000 and 2020, minority race populations are expected to increase to approximately 15 percent of the total population within the CRC regional area and approximately 11 percent of the total population within Davis County. The Hispanic or Latino (of any race) population is expected to remain the largest resident minority group within the CRC regional area and Davis County in 2020 (USBC 2000, USBC 2006a).

Table 3-14. Population of the CRC Regional Area and Davis County for 2000, 2010, and 2020

Population	CRC Regional Area			Davis County		
	2000	2010*	2020*	2000	2010*	2020*
White	1,380,700	1,572,763	1,707,481	220,486	251,157	272,670
Black or African American	15,606	21,174	25,448	2,615	3,548	4,264
American Indian and Alaska Native	12,307	15,577	18,246	1,379	1,745	2,044
Asian	31,991	43,324	53,179	3,665	4,963	6,092
Native Hawaiian and Other Pacific Islander	12,419	20,644	20,644	639	865	1,062
Some other race	73,719	98,545	122,304	5,501	7,354	9,126
Two or more races	35,357	—	—	4,709	—	—
Hispanic or Latino (of any race)	158,763	213,502	271,396	12,955	17,422	22,146
Total Population	**1,562,099**	**1,813,484**	**2,004,655**	**238,994**	**277,455**	**306,703**
Percent Minority	**11.61**	**13.27**	**14.82**	**7.74**	**9.48**	**11.10**

Sources: USBC 2000, USBC 2006a

* Projected population values for 2010 and 2020 do not represent absolute limits to growth; for any group, the future population may be above or below the projected value.

Note: Because an individual may report more than one race, the aggregate of the population groups may not match the total population.

3.2.1.7.2 Economy

Industrial sectors in the Promontory and CRC regional areas that provide significant employment include education, health, and social services; manufacturing; retail trade; and public administration. An estimated 350,789 people were employed in the Promontory regional area in 2000 with an estimated unemployment rate of 5.4 percent. Box Elder County's unemployment rate was 5.2 percent in 2000. An estimated 1,124,116 people were employed in the CRC regional area in 2000 with an estimated unemployment rate of 4.7 percent. Davis County's unemployment rate was 4.4 percent in 2000. The national and Utah unemployment rates during the same period were estimated at 5.8 and 5.0 percent, respectively. The estimated percent of persons living below the poverty level (low-income persons) in 2000 was as follows: U.S. – 12.4 percent, Utah – 9.4 percent, Promontory regional area – 8.7 percent, CRC regional area – 7.7 percent, Box Elder County – 7.0 percent, and Davis County – 5.0 percent (USBC 2006a).

The Promontory facility contributes significantly to the local, state, and national economies. In fiscal year 2006, the Promontory facility's budget was $604 million. The Promontory facility employed approximately 110 civil servants and 3,485 support contractors and the vast majority of these employees lived in Box Elder County, followed by Weber and Cache Counties (ATK 2006).

The Freeport Center, including ATK's CRC, is also a significant contributor to the Utah economy. The Freeport Center is home to more than 70 national and local companies that support a workforce of more than 7,000 employees (Freeport 2007). In fiscal year 2006, the CRC's budget was $33 million. The CRC employed approximately seven civil servants and 174 support contractors and the vast majority of these employees lived in Weber County, followed by Davis and Box Elder Counties (ATK 2006). ATK's Promontory and CRC facilities had a combined budget of $637 million and a workforce of 3,776 employees with a payroll of $228 million in fiscal year 2006 (ATK 2006).

3.2.1.7.3 Transportation

ATK's Promontory and CRC facilities have fully developed infrastructure, which includes road access and utilities to support their occupational needs. The Promontory facility is served by State Road 83 and the CRC is serviced by Interstate 15 and 84, and rail access. Salt Lake City International Airport is located approximately 64 km (40 mi) south of the city of Ogden.

The Constellation Program's solid rocket motors would face the same transportation requirements as the Space Shuttle Program's solid rocket motors. Incoming ammonium perchlorate is delivered to Corinne, Utah via rail and transloaded onto flatbed trailers by a hazardous materials-certified commercial trucking company and delivered to Promontory following U.S. Department of Transportation (DOT) regulations (ATK 2006).

At Promontory, the raw constituents of solid fuel are trucked to a mixing facility and mixed remotely in large mix bowls. The mixed propellant is transported to a nearby facility for casting into a solid rocket motor segment. Once loaded and prepared, the segments are transported to KSC in special rail cars. Any remaining solid fuel and partially processed solid fuel constituents are transported to an open burn facility. ATK has an approval order from the Utah Division of Air Quality to open burn energetic waste materials. Buildings housing explosives or solid fuel are placed sufficiently far apart to satisfy standoff requirements based on explosives quantities (ATK 2006).

DOT regulations also apply to transporting solid rocket motors to and from ATK. Transporting loaded solid rocket segments from Promontory to Corinne is conducted during daytime hours on specialized transports which must not travel faster than 32 km per hour (20 mi per hour). Approval to move solid rocket motors after dark must be obtained from the State of Utah Highway Patrol. When this is done, the roads are shut down and additional security guards are required to make the move. At Corinne, loaded segments are transferred onto railcars. The railroad carriers are restricted to 80.5 km per hour (50 mi per hour). These shipments are also escorted by ATK personnel from Utah to KSC (ATK 2006).

3.2.1.7.4 Public and Emergency Services

Access to the Promontory facility and CRC is controlled by security personnel. The closest community hospital to Promontory is approximately 39 km (24 mi) away in Tremonton. The CRC is serviced by several community hospitals within approximately 8 km (5 mi) (USBC 2006a). The Promontory facility maintains two onsite fire stations. In addition, it operates under an Emergency and Disaster Response Plan (ATK 2006).

3.2.1.8 Cultural Resources

The Promontory facility and CRC have no designated National Historic Landmarks or listings in the NRHP (DOI 2007a, DOI 2007b). Although no cultural surveys have been performed, there are no known culturally significant areas in close proximity to the facilities that would support the Constellation Program (ATK 2006). The Golden Spike National Historic Site, which is listed in the NRHP, is located approximately 4.8 km (3 mi) northwest of the Promontory test area (DOI 2007a).

3.2.1.9 Hazardous Materials and Waste

ATK uses hazardous materials for various research and testing activities, which in turn generate hazardous wastes. ATK is regulated both for generation and for treatment, storage, and disposal of hazardous wastes at its Promontory and CRC facilities, for which it holds a RCRA Treatment, Storage and Disposal Permit (number UTD009081357). ATK has management systems in place for hazardous materials and waste along with spill prevention control and countermeasure plans and pollution prevention/waste minimization plans (ATK 2006).

Wastes from current operations include propellant, paints, coatings, solvents, cleaning rags, catalysts, curing agents, polymers, and similar compounds. For the Space Shuttle Program, in 2004, the Promontory and CRC facilities generated and disposed of or otherwise treated 1.1 million kg (2.4 million lb) of hazardous waste. Hazardous waste is managed in several ways, including offsite treatment and/or disposal at permitted facilities, onsite thermal treatment by open burning, and onsite landfills (ATK 2006). All hazardous materials and hazardous wastes are managed in accordance with applicable Federal, state, and local rules and regulations (ATK 2006).

3.2.2 Other Commercial Facilities

The Constellation Program would be supported by various other commercial facilities throughout the U.S. It is expected that the activities engaged in at each commercial facility involved in the Constellation Program would fall within the normal realm of operations at that facility. It is also expected that all such facilities would be in compliance with applicable Federal, state, and local environmental laws, regulations, and permits. NASA would ensure that this is the case as a matter of contract with all commercial entities selected to support the Constellation Program.

3.3 GLOBAL ENVIRONMENT

In accordance with Executive Order (EO) 12114, *Environmental Effects Abroad of Major Federal Actions*, this section provides a general overview of the global environment. It includes basic descriptions of the troposphere, stratosphere, and potential landing sites for the Orion Crew Module and jettisoned Orion and Ares hardware.

3.3.1 Troposphere

The troposphere is the atmospheric layer closest to the Earth's surface (see Figure 3-25). This layer accounts for more than 80 percent of the mass and essentially all of the water vapor, clouds, and precipitation contained in the Earth's atmosphere. The height of the troposphere ranges from an altitude of 10 km (6 mi) at the poles to 15 km (9 mi) at the equator. In general, the troposphere is well-mixed and aerosols in the troposphere are removed in a short period of time as a result of this mixing and scavenging by precipitation. A narrow region called the tropopause separates the troposphere from stratosphere (USAF 1998).

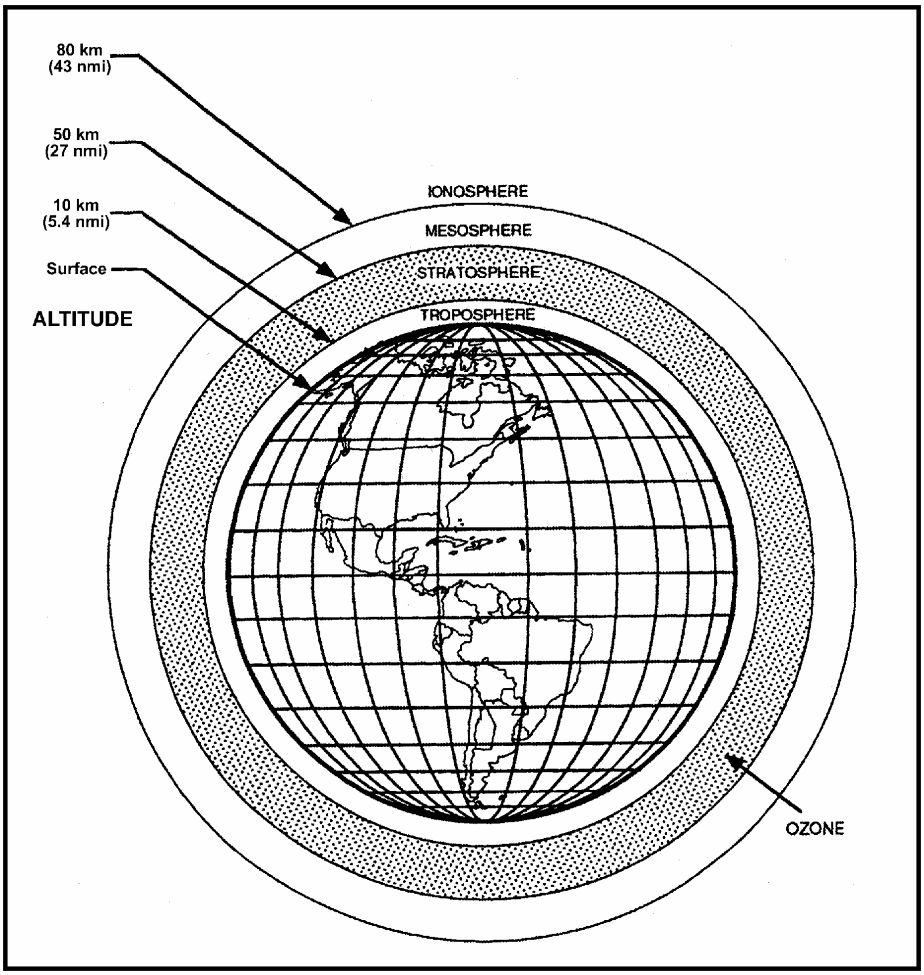


Figure 3-25. Atmospheric Layers and Their Estimated Altitude

3.3.2 Stratosphere

The stratosphere extends from the tropopause up to an altitude of approximately 50 km (31 mi) (see Figure 3-25). In general, vertical mixing is limited within the stratosphere, providing little transport between the layers above and below. Thus, the relatively dry, ozone-rich stratospheric air does not easily mix with the lower, moist, ozone-poor tropospheric air. The lack of vertical mixing and exchange between atmospheric layers provides for extremely long residence times, on the order of months, causing the stratosphere to act as a reservoir for certain types of

atmospheric pollution (USAF 1998). The Montreal Protocol, an international treaty ratified by the U.S., is designed to protect the stratospheric ozone layer by phasing out production and consumption of substances that deplete the ozone layer. It was first adopted in 1987 with additional requirements adopted through 1999. Recent measurements indicate that stratospheric chlorine levels are decreasing, consistent with expected declines resulting from the Montreal Protocol (EPA 2003).

3.3.3 Potential Landing Sites for the Orion Crew Module and Jettisoned Orion and Ares Hardware

Although both ocean and terrestrial landing sites for the return of the Orion Crew Module are currently under study, terrestrial landing sites are not addressed in this Final PEIS. In general, it is expected the terrestrial landing site(s) would be in the western continental U.S. and would consist of the following characteristics: a sparsely populated large, flat area of land without marshes, forests, boulders or ravines. At such time as the evaluations of terrestrial landing sites mature sufficiently, NASA will prepare separate NEPA documentation, as appropriate.

An ocean landing of the Orion Crew Module could occur in the Atlantic Ocean, Indian Ocean, or Pacific Ocean following an ascent abort, or in the Pacific Ocean off the western coast of the U.S. following a normal Earth atmospheric entry from the International Space Station or the Moon. A recovery team would retrieve the Orion Crew Module upon Earth return. Although specific landing locations are unknown at this time, the future selection process would avoid sensitive marine environments to the best extent practicable. Figure 3-26 illustrates the Federal marine protected areas off the U.S. West Coast.

The primary hardware that would be jettisoned during an Orion/Ares I launch would include the Ares I First Stage and Upper Stage, the Orion Launch Abort System, and the Spacecraft Adapter fairings. For an Ares V launch, the primary hardware that would be jettisoned would include the Core Stage, payload fairings, and SRBs. Similar components would be jettisoned during Ares test launches from KSC. These components would fall into either the Indian Ocean or the Atlantic Ocean, depending upon when each is jettisoned during launch vehicle ascent. In addition, the Orion Service Module and docking mechanism (for International Space Station missions) would be jettisoned into the Pacific Ocean during atmospheric entry. Components could be jettisoned into the Indian, Atlantic, or Pacific Oceans in the event of a launch ascent abort; however, the possibility exists that hardware components could fall on land. Under a normal launch, a recovery team would retrieve the Ares I First Stage and the Ares V SRBs. While all remaining hardware would not be recovered and would be expected to breakup in the atmosphere or upon ocean impact and sink to the ocean floor, some hardware components may remain temporarily afloat.

The Constellation Program is studying the possibility of not recovering the spent Ares I First Stage and Ares V SRBs for certain missions. This could gain additional performance margin for certain missions by eliminating the launch weight of the booster recovery systems.

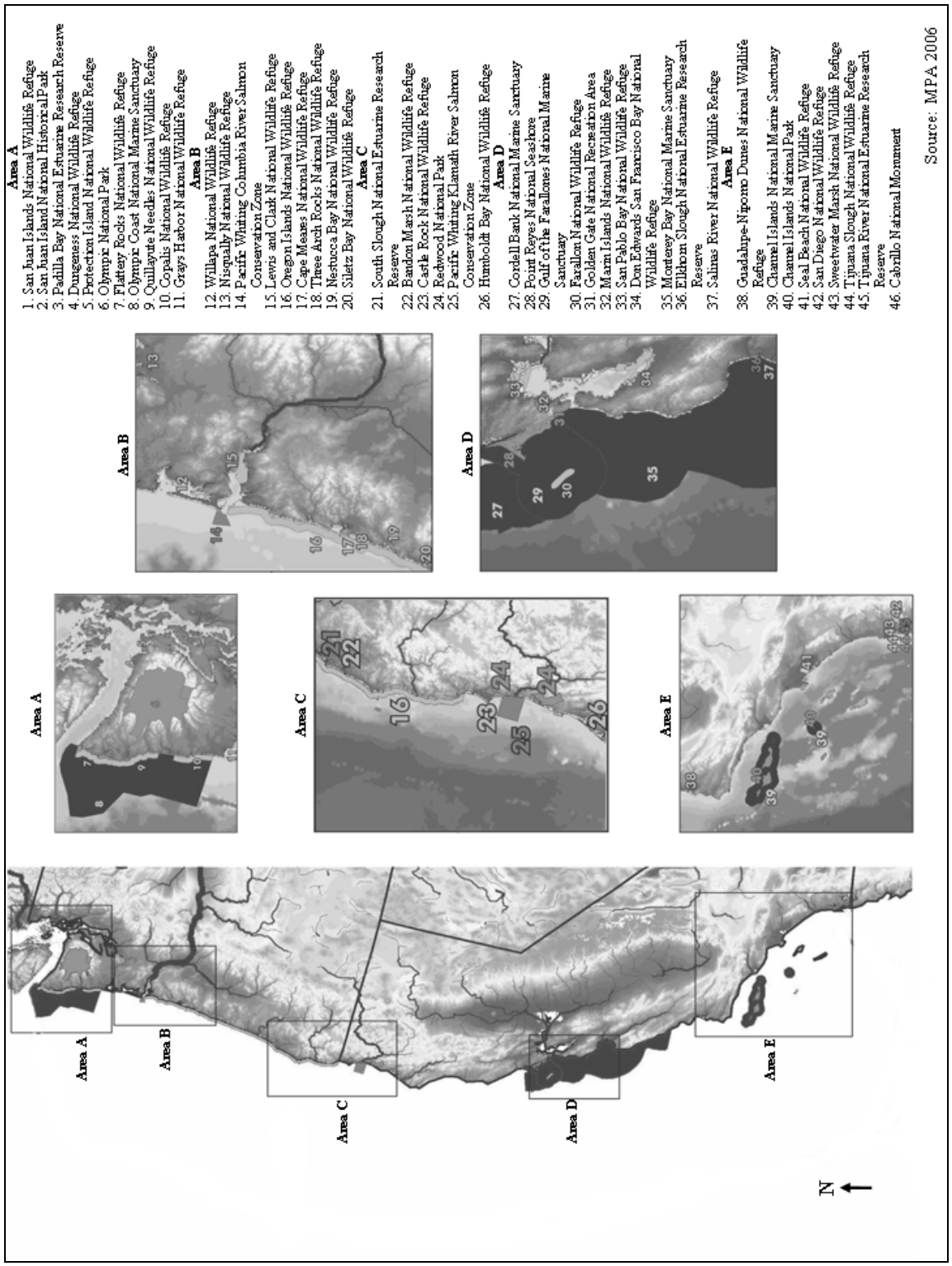


Figure 3-26. Federal Marine Protected Areas of the U.S. West Coast